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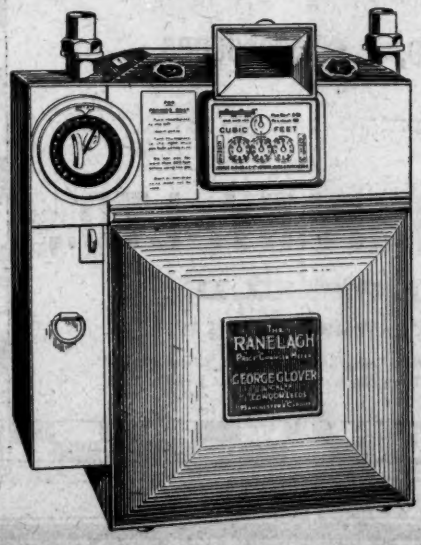

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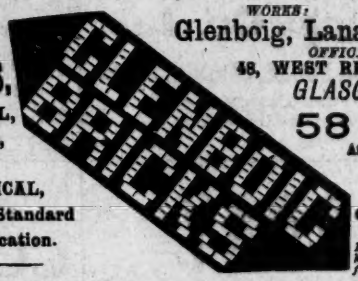

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CONTENTS.

EDITORIAL NOTES.

Gas Organization—Example of the American Gas Association 573
Changes of Policy in New Circumstances . 573
The Valuation of Oxide for Gas Purification 574
Serious Days for Trade Unions 575
Standard Gas-Cookers—Tar or Bitumen, or Both—Sensible Miners—Impermeable Concrete Oil-Tanks—The Rational Use of Coal 576
Therms and Cubic Feet—Fiction and Facts—What the Consumer Receives—Gas Coal Position 577

Personal 577
Electricity Supply Memoranda 577
American Gas Industry Organization Compared with British Methods. By Ald. Fred J. West, C.B.E., M.I.Mech.E. 579
North British Association of Gas Managers—General Business 580
Presidential Address of Mr. C. W. Fairweather 580
Gas Efficiencies—Discussion 584
The Valuation of Oxides for Gas Purification—Discussion 588
Gas and Food Preparation 589
Manchester and District Junior Gas Association—Visit to the Wigan Coal and Iron Company's Sovereign Pit 589
British Association Fuel Economy Committee—Fifth Report 590
The Function of Pure Science in the Field of Industry. By A. R. Myhill 593
Determining the Specific Gravity of Coke . 593
The Separation of High Calorific Gases from Crude Coal Gas 594
Factors Influencing the Ammonia Yield in the Carbonization of Coal. By H. D. Greenwood, M.Sc., and H. J. Hodsman, M.B.E., M.Sc., F.I.C. 595

CORRESPONDENCE.

The Smokeless City 597
Production Efficiency by Injecting Oil on to Incandescent Coke 597

REGISTER OF PATENTS.

Applications for Patents 600

MISCELLANEOUS NEWS.

King's Award for Bravery 597
South Metropolitan Co-Partnership Festival 597
Gas Regulation Act Applications 598
Harrow and Stanmore Gas Company—An Increased Sale of Gas 599
Hastings and St. Leonards Gas Company—Half-Yearly Meeting 599
Oxford Gas Light and Coke Company . . 600

MISCELLANEOUS NEWS—(*continued*).

The Nitrogen Position in Germany—The Prospect of Competition for Export . . . 600
Current Sales of Gas Products 601
Stock Market Report 602

PARAGRAPHS.

Flame Temperature of Gases 588
When Summer Time Ends—Institute of Paint and Varnish Technologists 589
Society of British Gas Industries—Eastern Counties Gas Managers' Association—Institution of Chemical Engineers—Will . 596
Successful Debenture Issue at Chester—Gas Exhibition at Derby 597
Good News for Halifax Consumers—Fire at the Portslade Gas-Works 598
Dudley's Opposition to the Therm 599
Price again Reduced at Swansea—New Companies—Retford Gas Profit—A Faulty Gas-Pendant 600
Sixpence Off at Leeds—Cheaper Gas at Lytham—Another Reduction at Newport (Mon.)—Kirkham Gas Company—A Further Reduction at Derby—The Therm Explained at St. Austell 601
Tynemouth Gas Company's Further Reduction—Dead Man and a Rifled Meter—Fire at the Bexhill Gas-Works—Therms and Reduced Gas Price at Milton Regis—Stockport Charges Reduced—Ellesmere Gas Problem 603

For List of "JOURNAL" Advertisers see p. 605.

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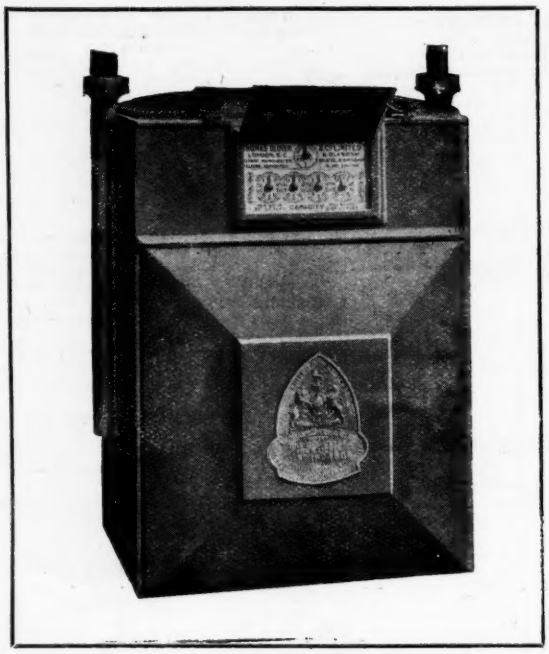

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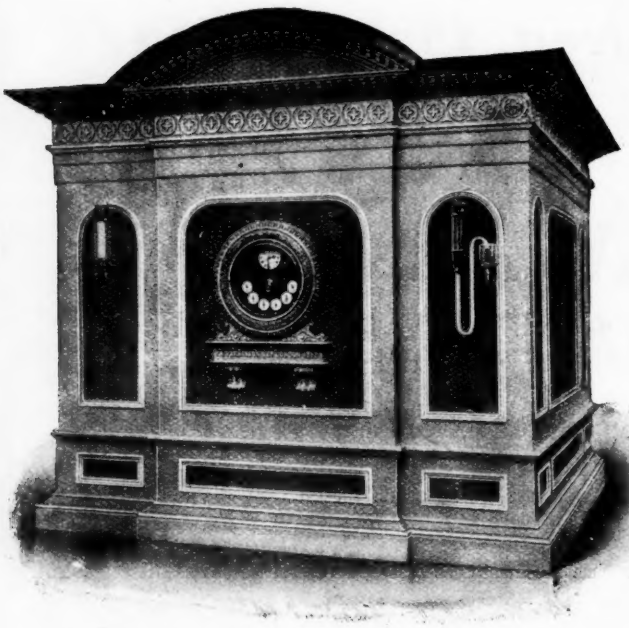

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EDITORIAL NOTES.

Gas Organization—Example of the American Gas Association.

ONE cannot but feel a great deal of sympathy with certain of the leaders among the manufacturers associated with the gas industry, in respect of a matter in which they represent a very general view on their side, and a view held very largely on the gas-supply side, though, unfortunately, not by some very influential men. It is the question of making complete the chief organization of the gas industry by filling up the gap which now exists in it, and so rounding it off. It may be asked, Why do the manufacturing section of the industry want this, and why are there so many men on the side of gas supply who are favourable to it? The reply is not to be found in personal aggrandisement. Anyway, that could only be a transient matter for individuals. But we believe sincerely that the reply is to be found in an earnest conviction on their part that the industry to which they belong and are attached would be all the stronger in efficiency and capacity both for protection and advance, and that many of the difficulties which now obtain through a feeling that a section is being unreasonably kept at arm's length from participation in the general work of the industry would disappear, by the simple process of incorporation.

In this month's "Bulletin" of the Society of British Gas Industries, Mr. Fred. J. West, C.B.E., has an article describing the development of gas organization in the United States, which has removed in the case of America the defect existing in this country. His personal observation assures him that what is the subject of phantom fears of difficulty in this country has good material effect in America. In other words, the properly organized machine of the United States functions smoothly and efficiently, to the best and largest interests of the gas industry. If this is the experience in America, why should it not be here? In America, the complete gas organization is not a new thing. There has been consolidation into one capital body since 1918; so that there has been four years' working, which has cleared away the ill-foreboding and suspicion which some entertained as to such an organization not working with the desired efficiency. The contrary has proved to be the case; and the advocates of consolidation have had their position justified. The advocates, too, have been strengthened by the passing of erstwhile opponents over to the evolutionary ranks. The experience has been such that in America there will be no going back from what has been done in this regard. Consolidation has been given a good trial, and has been found a vast improvement upon the separate state; and that is sufficient. We feel confident that Mr. West's description of what has taken place there—a description framed in plain and convincing terms—will harden the adhesion of the manufacturers and their supporters in the gas-supply industry to the policy of consolidation of British gas organization, with co-ordination of work.

The article (we reproduce it to-day from the Society's "Bulletin") tells us that the American Gas Association is sectionized. One of the sections deals with accounting or financial matters; a second, with advertising and publicity; a third, with commercial matters; a fourth with technical affairs; and, finally, there is the manufacturers' section. That is practically what could happen by the consolidation of the present organizations of the gas industry at home. The composition of the organization and the procedure at the meetings are practically on the lines advocated by Sir Arthur Duckham some time ago; and there is a likeness with the system of our own British Association. It brings about a complete unity of effort; and it works well to the one common objective of the maintenance and progress of the interests of the gas industry. There is in the American Gas Association a living illustration of practically what is desired in this country, together with the testimony of good success. By taking counsel together there might even be improvement upon the example. No one can deny that, until the defect of isolation of the manufacturers is remedied, our chief organization is incomplete, and that our technical and commercial interests are not securing the advantages that must arise from common counsel and movement. We are not to-day the compact force that we should be; there is a floating element away from the main part of the force. That floating element is highly important to our well-being—to our competency and efficiency; and especially so in these days when the industry has so much to do, and when all available aid should be combined to realize the utmost effectiveness in every part of the industry's complex activities. The industry has enemies enough. We have had grave illustration of this recently. Yet there is resistance to the concentration of maximum strength. There is something illogical about it all. Mr. West's observations allow him to state that the American gas industry is now provided with a well-organized and powerful central operative body; and his article obviously means that the gas industry of the United States, in this respect, has shown greater wisdom than we have in this country. The continuance of the present conditions is a detriment to the gas industry here. That statement is deliberately made. It is worth meditating over; and, after meditation, action to the end of total consolidation.

Changes of Policy in New Circumstances.

THE members of the North British Association of Gas Managers met last Thursday in the historic town of Ayr, under the presidency of Mr. Charles Fairweather, of Kilmarnock. An excellent programme had been prepared for the occasion; and it was carried through precisely with the scrupulous eye of the Hon. Secretary (Mr. D. Fulton) upon both plans and timetable. Naturally, the chief item in the proceedings themselves was the Presidential Address. Mr. Fairweather in this did not, interesting as they are, go wandering into a discussion of the many problems that confront the gas engineer and manager to-day. In the address, they cropped-up merely in an incidental way, when dealing with his own experiences at Kilmarnock. All through the composition, in fact, the President kept closely to his own personal experiences drawn from everyday practical work. They were many, and covered a large area of topic. Several of the features of the composition would have general application; some of them would not. It is in the latter that one finds the greatest interest. By them we are reminded that environment largely governs experiences; and that owing to differing environment, the judgment and decisions of gas engineers will, and must, vary in marked degree. But with passing time, environment may change to such an extent—just as economic conditions have done—that judgments and decisions have to be revised. Of this we also have illustration in this deliverance; and the day will come when, if Mr. Fairweather is called upon to write another Presidential Address, and chooses personal experiences as his topic, he will—at all events in connection with gas production—show that his selection of pre-war days has undergone change

with mutation in conditions. The war, in fact, has made a vast difference in the circumstances and outlook of those responsible for gas undertakings, wherever located.

The address gives some account of the early history of the Kilmarnock Gas-Works, and as to the transfer of the concern to the Corporation in 1872. Since then there has been development of a marked order—the consumption having increased from 28 million cubic feet to 289 last year, despite the fact that electricity has been in competition during the greater part of the period. All the changes that have occurred in these respects have produced new factors in technical consideration and decision. It is the duty and object of the engineer to make the best possible of the conditions that surround him. In doing this he has to exercise as much foresight as possible; but the trouble is that foresight is controlled largely by more or less speculative influences, through the future being so closely veiled. In the development of the works at Kilmarnock, a new site at Riverbank was selected, in connection with which the economy of siding accommodation could be obtained; and here prudently the gas and electricity works were placed side by side, so that they could jointly benefit from the handling of material by the one set of facilities. A large annual saving is thereby effected. There comes a prominent illustration of how mutable conditions produce changes in judgment. At first the Riverbank works were equipped with horizontal retorts; but in 1914 an installation of sixty intermittent vertical retorts were put into operation. The main consideration which led to intermittent retorts being adopted was that in the neighbourhood there is a large field of coal of low quality, consisting of low-grade shale, cannel coal, &c.; and some qualities of these materials have been bought for gas making at as low a price as 3s. 6d. per ton at the pit. In those days coke was a poor asset; and so it was then decided to put in plant that would best deal with the cheap grades of materials. But the war was destructive of old conditions, and established new ones. The demand for gas coke grew, and became insistent. Good coal had to take the place of the low-grade coal; and so the original purpose of the installation of intermittent retorts disappeared. Now the steaming of the charges in continuous verticals with the high-class coal would be an economy —just as it was at one time an economy to use intermittent verticals for the low-grade coal. With the intermittents, steaming can only take place at the tail-end of the carbonization period; while with the continuous retorts, it can proceed without interruption.

As far as possible, however, compensation has been secured by the erection of a blue water-gas plant, the conditions of the working of which (as described) present some interesting features. In the circumstances with which he has to deal (this is not what Mr. Fairweather would call ideal operation, nor the procedure he would select under circumstances that gave him more liberty), the blue water gas is delivered to the exhauster outlet. The arrangement has proved efficient, and has avoided the necessity for the water gas passing through the exhausters and upsetting their steady working. It is surprising with what ease and efficiency a good exhausting plant will work against a varying back pressure, for this is what the delivery of gas to the exhauster outlet means. Of course, the advantage is lost of the delivery of the water gas into the hydraulic main, there to meet and to be mixed with the hot coal gas. That is the practice which Mr. Fairweather would prefer; but circumstances debar him from carrying it out at present. A limited amount of carburation is practised by spraying about half a gallon of oil on the top of the hot coke in the generator on the down run for about two minutes; but this is a crude system, as the President tacitly admits when he says that perhaps in time a carburettor, a superheater, tar separator, &c., will be installed. It will be admitted that, through the circumstances of his position and the changes in conditions that time has effected, Mr. Fairweather is not working under the most generous conditions in respect of plant to realize maximum results. But, subject to those conditions, he is doing exceedingly well. The result of the combination of coal gas from the intermittent verticals, the blue water gas, and moderate carburation, is a production of 16,500 c.ft., of 450 B.Th.U. gas gross, or 74·25 therms per ton of coal.

Passing from production to use, good experience with the "A. & M." pressure-wave controllers for the public lamps is recorded. In applying the system, an important point is that each lamp should be loaded for its particular situation. In fact, from the institution of automatic control into the working period, the President believes very strongly in liberal attention. Even with the cost of this, there is a substantial saving; more important still, there is satisfaction. There is a reduction of labour, and economies in other directions; but the idea is good that such savings should at any rate be partially devoted to the maintenance of a high state of efficiency in street lighting. This done, fewer lamps are required than would otherwise be the case in a given area—particularly if the lanterns are kept clean.

An interesting table is that which presents the growth of gas and electricity consumption in Kilmarnock since 1905. The population has been almost stationary during those years; and the Electricity Department has the advantage that its area extends over a large portion of the county. Notwithstanding, the quantity of gas manufactured has moved from 163,354,700 c.ft. to 289,000,000 c.ft., or an increase of 125,645,300 c.ft.; while the electricity generated has advanced from 236,259 to 17,333,660 units. Despite the fact that gas had established itself to the extent of 163,354,700 c.ft. in 1905, and that electricity had practically wholly (electrically speaking) undeveloped soil upon which to work, the increase of gas and the progress of electricity have, on the thermal basis, proceeded with almost equal pace. The advance of gas represents (on a 450 B.Th.U. basis) 565,403 therms, and of electricity 584,731 therms, which is a small difference bearing in mind that the electricity area is considerably larger than that of the gas supply, and that the latter, when electricity started, had already a considerable business.

This reference to the expansion of consumption and the fact that gas is now subject to keen competition, led the President to dilate on the policy which should govern gas administrators. In this respect, too, things have changed greatly, and therefore so must policy. Selling gas, Mr. Fairweather says, is a more expensive thing now than it was twenty years ago. This depends on how one looks at the matter. More money in the total may have to be spent now than then by an undertaking; but it must not be overlooked that, in the case of nearly every consumer in these times, a much larger business is done than was the case twenty years ago, and spread over that business the money spent may not be more per therm or per 1000 c.ft. The system of hiring apparatus and the manufacture of therms at the cheapest possible rate are two of the means by which business is developed and maintained. But that is not enough. There must be efficient distribution; and officials of gas undertakings must go out among the consumers and work in co-operation with them. A fatality in Kilmarnock, through an owner's defective pipe, led the Corporation to adopt a very wise policy. Now the fittings of all classes of consumers are inspected—particularly in the poorer localities, where the prepayment meter is so common, and where the appliances are subject to the utmost conditions of wear and tear. "Our inspectors are constantly passing among consumers "and reporting, not only on the condition of the fittings "belonging to the Gas Department and appliances on hire, "but are also reporting on the condition of the proprietors' "fittings over which we as a department, of course, have no "control." That is good policy; and this a correct attitude: "We now take up the position that where a proprietor's "fittings are out of repair to such an extent as to render con-"tinued supply dangerous, we ask that the defect should be "rectified; otherwise we discontinue the supply of gas." The gas industry has to think of its reputation; and this is one of the means by which it can be kept unblemished. Among the several other subjects dealt with in the address, a broad policy in connection with maintenance is also advocated. It may be summed up by the words that the object of the gas manager to-day must be: "The maximum sale "and service, at the minimum price."

The Valuation of Oxide for Gas Purification.

A VALUABLE paper on the above subject [*ante*, p. 471] was read before the North British Association by Mr. G. H. Gemmell, F.I.C., the Official Analyst to the Association; and it will be of particular advantage to those works that cannot boast of a chemical department, and not without interest to those that can, as it is well known there is much respecting what goes on inside a purifier about which there is but the vaguest of knowledge. Moreover, even in some works with chemical laboratories and staffs, the testing of natural bog ores or artificial oxides is not carried out with

that thoroughness which should exist, in order to ensure that the right material is being purchased. But though there is a great deal about the work of a purifier regarding which knowledge has not been stabilized by science (as has been seen by the investigations of the department of the Chief Inspector under the Alkali Works Regulation Acts, and by not a few papers that gas chemists have found contain considerable controversial matter), it must be said that in many works purification costs have been brought very low per 1000 c.ft., and that the efficiency of purification has been good in respect of sulphuretted hydrogen.

The point, however, is that this is not uniformly so; and the reason is probably due more to the purifying material employed than to working procedure. We have known of different gas-works where the process followed, the size of purifiers, and the demands upon the purifiers, are almost identical; but the purifying results are not. Why is this? Mr. Gemmell would answer that it is owing very much to the varied chemical and physical properties of the oxide. Therefore it is necessary to know accurately the absorptive power of the material; and this cannot be found by any single test, but must be the result of many successive tests over a good period of time. Although he has been engaged on a large amount of experimental work with different bog ores and artificial oxides, he is satisfied that much more requires to be done before an attempt could be made to fix a definite standard which an oxide should pass. It would be a valuable thing if this could be done. Some of the technical staffs of gas-works have, to their own satisfaction, adopted a standard; but there is little evidence that in all cases the tests they apply are the searching ones that Mr. Gemmell asserts are requisite. In fact, his study of the published literature on the subject assures him that the reaction between oxide of iron and sulphuretted hydrogen is not completely understood. As to the material, there is not equal activity between oxides from different sources; and some purifying materials contain oxides incapable of reacting with sulphuretted hydrogen, or the reaction may be slow and the revivification tardy. Some oxides, too, may be active at first, and then slow down; while quite the reverse may also happen. Among the factors that affect absorptive activity and capacity are physical condition, temperature of the reacting bodies, percentage of free and combined water, and the influence notably of the acidic or basic constituents. Supplementary is the effect of ammonia, cyanogen, tar, and other constituents in the gas itself.

With oxides varying so considerably in activity and capacity, there is good ground for saying that all that is entitled to the name of oxide of iron is not necessarily suitable for purifying purposes, to secure the highest purifying efficiency. What the gas engineer wants to know is which of the materials he is offered is the best to purchase; and yet Mr. Gemmell is satisfied that knowledge is not sufficiently full and precise at present for establishing a reliable standard. From his tests he has arrived at the conclusion that the estimation of water and oxide of iron content of the material is not sufficient to arrive at the value of the oxide, and that a laboratory fouling test, combined with these data, is necessary to obtain a true valuation of the oxide. Therefore, he has directed his experiments to a determination of the maximum quantity of sulphur which an oxide would take up *after repeated foulings and oxidations*, the final weight of the fouled oxide, the weight of the sulphur in the final product per 100 parts of oxide taken, and the ratio of sulphur absorbed to the oxide originally present. There is in some quarters objection to laboratory tests, and a preference for tests that approach nearer to actual working; but we must in such matters as this have regard to practicability. It is not always practicable to make working tests when purchasing a material. Time is an important factor in respect of purifying materials, and especially if repeated foulings are necessary to assess true value. Mr. Gemmell submits that the tests carried out by his method give, with good bog ores, results corresponding to those obtained in actual practice; and this is ample evidence of the reliability of the method. The tabulated results are confirmatory of this, and in addition of the considerable differences there are in the sulphur-absorbing capacity and efficiency of various oxides. The paper, as will have been seen, describes the testing procedure adopted by the author. The data, it will be remarked, show some surprising results in the behaviour of different bog ores. It is also established that it is a mistake to suppose that a single complete fouling with sulphuretted hydrogen enables one to judge the relative value of various oxides—in other words, a comparison of the results obtained by one fouling and thirty foulings does not show any definite ratio.

The conclusions drawn by Mr. Gemmell from his experimental work are that better results are obtained at a temperature of about 100° Fahr. than by fouling at ordinary atmospheric temperatures. Ignited oxides, he finds, give better results than hydrated oxide. The former always took up water to the extent of 5 to 8 p.ct.; and water certainly keeps the oxide in a more suitable physical condition. There are, of course, varied views in professional circles as to the percentage of moisture that there should be in oxide. It is generally in excess of the figures mentioned by Mr. Gemmell, running from 10 to 20 p.ct., and in some cases as high as 20 to 30 p.ct. The percentage of Fe_2O_3 in the oxide is no criterion of its value for purification. Dilution of oxide with sawdust to expose a relatively greater area to the gas does not, he finds, increase the fouling value. There are, of course, the other effects—the increase of permeability, and the moderating of the activity of the material. The other conclusion is the one already referred to—that no definite determination can be arrived at from one fouling, but that after twenty to thirty foulings a good oxide will contain from 50 to 60 p.ct. of sulphur, it will increase in weight by more than 50 p.ct., and should yield 80 to 100 parts of sulphur for every 100 parts of oxide originally used; also that it should yield not less than three parts of sulphur to each part of Fe_2O_3 in the original oxide, and must not contain more than a definitely fixed proportion of water. We hope that Mr. Gemmell will continue his work in this direction, as it is highly important that all that there is to be known about the efficiency of oxides differing in chemical and physical characteristics should be in the possession of the gas engineer.

Serious Days for Trade Unions.

IT is only natural, when things are not going right, there should be a disposition to grumble. Things are not going right or well for some of the trade unions. Conditions are altogether out of joint with their policy; and those conditions, economic and international, are much stronger than combinations of men. The conditions are more or less universal; and they are concentrating themselves very largely upon industry, and the workers in industry are feeling the effects in conjunction with the rest. Unemployment is rife, the trade unions are financially in low water through the drains upon their resources by unemployment, and the costs of the strikes entered into in support of the policy of resistance to the compulsory effects of altered economic circumstances. The leaders of many unions have shown themselves past-masters in the art of being impolitic, and of demonstrating that they have not the capacity for recognizing conditions which neither they nor other men have the power to resist or to turn back. The result is seen in the fact that, at the Trade Union Congress last week, it was shown there was a decline in trade union membership of no less than 1,290,608—the delegates representing on this occasion 5,127,308 members, as contrasted with 6,417,916 twelve months since. That is a decline of upwards of 20 p.ct. in twelve months. Many of those who are now members are on short-time work, and cannot therefore properly afford to subscribe to their union funds.

However, some scapegoat for the conditions which have brought about this unwelcome state has to be found. The President (Mr. R. B. Walker) discovered the perennial one of "capitalism." He agreed that industrial depression has caused unemployment and loss of wage-earning power. So far so good; but what has caused industrial depression? We need not set-out the several factors here. They are well known to our readers; but Mr. Walker alighted on the capitalist system. It has, according to him, stood its trial, and has failed to justify itself. It stands revealed, in its national and international activities, as the ruthless enemy of the vast masses of the people of this country. To support his denunciation, Mr. Walker advances no reasons. He simply asserts that capitalism has failed to provide an adequate means of living for all. What has trade unionism done by its policy for many of the workers of this country during the last two years? What has communism done in Russia? It has simply destroyed the industries by which the Russian workers used to live. Capitalism cannot be destroyed without the loss of the capital upon which labour depends. There is no escaping this truth; fancifu postu-

lation and plausibility on the part of trade union leaders will not alter the facts. It is to be feared that Mr. Walker's prediction that the coming winter will be a hard one for many people is quite a correct forecast; but there will not be relief—things would be worsened—if labour sets itself against capital, instead of endeavouring to pull with it for a betterment of conditions. There are signs of a revival of trade; but there is as yet little that is material behind them. The causes of the great disturbance are many, and they are deeply rooted, so that recovery is likely to be slow. This is to be regretted, but it cannot be helped.

It is a matter for congratulation that, generally speaking, the gas industry, its employees, and their union representatives are on good terms, and that there is an ability on both sides to examine matters from the other's point of view. The Trade Union Congress has, however, disclosed something which would have been remarkably ineffective had there been any serious attempt to apply it. There was a brief discussion on the recent dispute in the engineering trades; and Mr. J. Hill, of the Boilermakers' Union, stated that the question of stopping the public utility services of London was at one time considered as a means of bringing pressure in favour of the engineers. But he confessed that it was given up as being an impracticable solution of the difficulty. That was a very sensible decision; but the discussion showed that there were other views on the question—the views of extremists, whose methods to secure their own ends include the throwing into disorder of the conveniences and necessaries of the masses of the people. One of these extremists was fully persuaded that the result of the engineering struggle would have been very different had the men engaged in public utility services come out in their support. But he supplied no reason as to why they should, to help the engineers, have taken such insane action. In the gas industry at any rate, we know that among the counsellors of the men there is more common sense than the extremists evidently give them credit for. As one delegate—Mr. Kelly—rightly observed, no one can seriously believe that the engineering employers in Glasgow or Newcastle would have been in the slightest degree injured or influenced by the throwing of London into darkness. So think most people. It is men such as those who advocate extravagant action of the kind to achieve their ends who do so much damage to the cause of labour. They forget the weight of public opinion.

Standard Gas-Cookers.

Now the makers of gas-cooking stoves can set to work in getting things into train for making standard gas-cookers in accordance with the specifications approved by the National Gas Council. It will be seen from an advertisement appearing elsewhere in this issue that the Council are inviting tenders for lead master patterns, original cast-iron ones, master jigs, specimen cookers, base stands, lead and cast-iron patterns for stands, and plate racks. Applications (not later than Oct. 4) for the necessary drawings, specifications, forms of tender, contract conditions, &c., are to be made, with a remittance of £25 (which will be returned on a *bona-fide* tender being submitted), to Mr. W. J. Smith, the Secretary to the Council. Fuller information is given in the advertisement.

Tar or Bitumen, or Both.

A warning is issued by Mr. Charles Fairweather, in his North British Presidential Address, that there must be care on the part of the gas industry in order not to lose the large and valuable market for tar for road purposes. The question has been raised as to whether bitumen is not the better substance for both road making and dressing, in view of its ability more effectively to stand changes in winter conditions. Mr. Fairweather appears to think that it is not tar that is unsuitable for road purposes, but that its use has been overdone, or it has not been applied in the best manner. He does not see that there would be any difficulty in adding to tar a proportion of bitumen (so as to maintain the former as the chief ingredient) to secure clean, good wearing roads. As tar producers, it is the business of gas engineers to supply road surveyors with the best possible material. This is a matter upon which there should be some amount of concentration before business is lost.

Sensible Miners.

Mention was made last week of the fact that the Stanton Coal and Iron Company had closed down their Silver Hill Collieries, owing to the losses that were being incurred upon them. Up to the time of closing-down, the miners had made no suggestion of sacrificing part of their wages to do something towards meeting the loss. The Company were losing £1500 a month by keeping the collieries open. In anticipation of better times, they were quite willing to share the loss with the men. The men, having had leisure, and so time to think over the matter seriously, have agreed to wage reductions amounting in the aggregate to £600 per month. The Company on their part will re-open the pits, in the hope that time will convert the loss into a profit.

Impermeable Concrete Oil-Tanks.

Mr. Reginald Brown, M.Inst.C.E., has been studying the question of how to render concrete oil-tanks impermeable. He has described the results in the "Petroleum Times." The method consists of reducing the porosity of the concrete and neutralizing the free lime therein by the application of a special liquid after the concrete is made and set, and subsequently applying a coat of oil-proof compound immune to the action of the oil. The neutralizing liquid must enter into the concrete to counteract any injurious effect of free lime present upon the oil-proof compound, which is simply brushed over the surface. The importance of the results of the experiments lies in the fact that without treatment concrete tanks may show a very serious loss of oil contents. Assuming a tank 20 ft. deep and 21 ft. in diameter, with walls 1 ft. thick, with a 6 p.ct. absorption, there would be a loss of at least 950 gallons of oil. This is serious enough, but as the concrete in the tank is under pressure, due to the head, there is likely to be a loss by absorption alone of some 1100 gallons of oil, while this amount is very largely increased by oil passing through the concrete itself.

The Rational Use of Coal.

In an article in the "Compendium," Prof. H. E. Armstrong, F.R.S., Ph.D., &c., deals with "Energy and Smokeless Fuel." The article is a plea for evolution, and for the rational use of coal. The name of the author is sufficient to assure us that the rational use of coal is by low-temperature carbonization. He says that all the disabilities attending the use of raw coal are, if not entirely overcome, greatly diminished if coal be first washed, and then subjected to carbonization at low temperature. He admits, however, that the introduction of smokeless fuel is not a simple problem. The interests concerned are many and varied. The producers of coal as well as the users must be considered, also the fact that users have different requirements. It is a national duty to make the most efficient use possible of our coal stocks, especially to avoid all waste in mining, and then all wasteful use. The interests concerned must take common action to these ends. In the past, to ask for this would have been madness. Is it now? We think not. But there comes the trouble that all people are not in agreement with the Professor that there is only one line to common action. However, it appears that in Prof. Armstrong's view, low-temperature carbonization would result in mining economies, as the coal need not be won in large blocks; it may be in the form of small coal or slack. The small coal would then have the value of large coal, provided it were carbonized as soon as it was brought to bank, so that it did not deteriorate by oxidation. He refers to the oils and smokeless fuel that are produced by low-temperature carbonization, and bears testimony to the superior value of the latter. We wonder whether Prof. Armstrong has yet had experience of coke produced by high-temperature carbonization, in which attention has been paid to the structure of the coke, as is proposed by Messrs. Sutcliffe and Evans. Coke such as they suggest has a combustible value, so it is said, equal to coke in which a considerable amount of volatile matter is left and so is lost. He is confident that low-temperature carbonization is now ripe for practical application—preferably at the pit head. But he says nothing about the use of the gas for enriching town gas. This would mean the utilization of low-temperature carbonization at gas-works, which would then be the distribution centres for the quantity of bye-product smokeless fuel produced. Prof. Armstrong is a peaceful man; but apparently he has had nearly sufficient of the so-called neglect of this question. In the concluding paragraph of his article, he observes: "I am no advocate of compulsion; but if action be not soon taken, I shall be prepared to join with those who would force an issue."

Therms and Cubic Feet.

Attempts continue to be made to keep alive the gas account controversy; and from within the industry itself there has been, from one or two quarters, somewhat violent effort to keep going the flames of discontent. At the bottom of the business, the therm is still supposed by some people to be responsible for an increase of the bills. Nothing more absurd ever obtained currency in connection with the gas industry; and we are confi. dent that the day will come when the therm will be blessed and not reviled. There are within the industry some people who want to continue the cubic feet basis of charge—of course, not with the view of hoodwinking the public where possibly very low-grade gas is supplied. Supposing the price is 10d. per therm in two places—one supplying 500 B.Th.U. and the other 250 B.Th.U. gas—the former would on the cubic feet basis have to speak of gas at 4s. 2d. per 1000 c.ft., and the latter could talk of gas at 2s. 1d. per 1000 c.ft. We prefer in fairness to the public to speak in terms of therms.

Fiction and Facts.

While there has been all this talk about heavy increases in gas bills, and an endeavour to make people believe that such increases are common, the books of gas undertakings only show, for the past half year, quite normal conditions—more especially when we remember how during the coal strike (the whole of the June quarter) last year, people complied with the appeal to economize, and the sun gave them plenty of inducement to do so. Mr. A. F Phillips, at the Harrow Gas Company's meeting last week, returned to the subject of these increases. All that the sale of gas did in the case of that Company during the half year was to increase by 4·84 p.ct., which is not abnormal, and to advance the rental by 3 p.ct. This is a very general experience. Mr. Phillips referred to the case of another company with which he is connected, in which examination of the accounts of 164 consumers, taken haphazard from the rental-book, showed that 82 had increased, 69 had decreased, and 13 were the same as in the corresponding quarter. The total advance in the rental only amounted to 4 p.ct.! It ought to have reached to over 100 p.ct. according to some newspapers.

What the Consumer Receives.

Mr. Ed. C. de Segundo has been writing to the "Evening Standard" on the subject of the declared calorific value and what the consumer actually receives. In many respects we have an admiration for the views of Mr. de Segundo; but in this particular, it is clear that it is a case of a little knowledge being a dangerous (or misleading) thing. His letter shows that he is not fully conversant with the matter of testing for calorific power. He says it is not stated at what pressure the declared calorific power is tested. If the gas is tested at the initial pressure at the works, then—as a gas-meter measures volume, and the volume of gas varies inversely as the pressure—it is clear that only the consumers near the works get the full number of B.Th.U. in their gas. That is what Mr. de Segundo holds. If he will study the prescription of the Gas Referees for testing the calorific value of gas, he will find that it is tested at fixed pressures, and that the minimum pressure of gas supplied to the consumers has now to be 2 in. in the consumers' service-pipes. He will ascertain that his own point in this respect is completely covered. Adopting his argument, the consumers in the neighbourhood of the gas-works would be getting much more than the declared value per cubic foot, while the consumers on the limits of the district would be getting their full calorific value. The official tests in London and many other places are not made at the gas-works, but on the district. He talks about the air supply to burners being generally "fixed." Air regulators are adjustable—not fixed. He speaks of the illuminating power standard, and then of the "new system" being introduced in the winter of 1920. As a matter of fact, the introduction of the calorific standard for gas dates back to 1912. It was the calorific unit charge that was introduced in 1920; and in the case of some companies, this only meant multiplying the cubic feet consumed by the calorific standard (which had always been certified by the official tests of the appropriate local authorities), and dividing by 100,000. Mr. de Segundo had better dip deeper into the history of this matter, and into the rules and regulations made for the protection of the public. At the present time his information is defective.

Gas Coal Position.

The settlement of the coal strike in the United States has lightened considerably the demand for coal for shipment; and so a complete change has come over the gas coal situation in Durham and Northumberland. An easier feeling prevails; and supplies have almost suddenly become more plentiful. Even for the best sorts in Durham, from 23s. to 24s. per ton was being quoted last week, and for second classes there is a willingness to book orders at 21s. to 21s. 6d. In all fields the collieries supplying gas coals are busy under contracts; and reports are quite cheerful as to the general demand for industrial coal having taken an upward turn. Yorkshire, it seems to us, has secured a large part of the business with gas-works; but it is said that it has hardly come up to the expectations of what would be the share of the collieries in that area in the current year's business. Yorkshire unscreened is in abundant supply; and transactions in it are now increasing.

PERSONAL.

Col. WILLIAM R. GLOVER, C.M.G., D.S.O.; has been elected one of the representatives of the Society of British Gas Industries on the Life of Gas-Meters Joint Committee, in place of the late Mr. Thomas Glover.

Mr. JOHN ALLEN HARRISON has been appointed second assistant to Mr. J. E. Blundell, Gas Engineer to the Corporation of Carlisle.

The Johannesburg Town Council have decided to investigate the prospects of extensions to the municipal gas-works, and have appointed Mr. HERBERT J. IBBOTSON, of Barsdorf's Building, Marshall Street, Johannesburg, as Consulting Engineer. The preliminary report will deal with the desirability or otherwise of fractionating tar and manufacturing sulphate of ammonia. The capacity of the present plant is about 250,000 c.ft. per day, and the retort-bench consists of direct-fired settings. There are 800 consumers in the comparatively small area of the town that is piped, while the total European population is about 150,000.

ELECTRICITY SUPPLY MEMORANDA.

IF ever an industry required to indulge in a little introspection, that industry is the electrical. Its journals have been making merry over the therm; and the most notable characteristic of this has been its puerility. One paper has even gone so far as to waste money and space over publishing something that looks like a photograph of one of the effigies of prehistoric animals to be seen in the grounds of the Crystal Palace. Underneath are the words "First Actual Photograph of the Gas Therm." This is "technical" journalism as recognized by at least one electrical paper; and we and possibly many others think but little of this mixing-up of very thin humour with the serious business of a great industry. Compared with electrical units, the therm has marked simplicity. And what is more, electricians who are not brainless are well aware of the fact. It is simply 100,000 times a measurable physical quantity; and the appellation "therm" has distinct relation to the quality of which it stands as the descriptive measure. Can this be said of all electrical units? Are there any of the electrical units that the professional men of the electricity industry can say are fully appreciated by the public? We do not think there are. The foolishness of the merriment over the therm is accentuated by the abstruseness, from the public point of view, of electrical terms. While the "Electrical Times" makes merry over the "therm" and publishes a picture of an animal the genus of which cannot be placed as representing a definite physical quantity, it admits, in another column, that "we have on several occasions urged that, when appealing to the public, members of the electrical industry should as far as possible avoid using technical terms." If that means anything, it is that technical electrical terms are beyond the compass of the layman. The remark introduces a letter by Mr. H. F. Simon, which this gentleman was induced to write by a previous statement of the "Electrical Times," that, "the average consumer is probably ignorant of the very meaning of the term 'heat storage apparatus.'" In the opinion of the correspondent, "this remark raises a very important point, especially at the present day when all of us interested in the electrical industry are endeavouring to do all within our power towards educating the non-technical public on matters connected with the use and application of electricity for every day service." Mr. Simon's experience teaches him that the average non-technical layman has not the remotest knowledge of the meaning of the simplest technical terms. He submits that printed matter containing such words as watts, volts, ampères, units per hour, heat storage apparatus, candle power per square foot, &c., are Greek to the average layman. Yet there is this silly attempt to deride

Therms and Technical Terms.

the therm. The therm has a definite connection with quality and value; and so it is a good unit upon which to base charges to the consumer. It at all events has association with the thing supplied, and that is more than can be said for basing charges for electricity on the rateable value of a house

Troubles with Electrical Appliances.

It seems that in America troubles are experienced with electrical appliances just as in this country. It may be said that troubles here with electrical appliances are no exception, but are a general rule. The same contemporary informs us that, to determine the causes of trouble with domestic appliances, and their "possible" elimination, the Society for Electrical Development of the United States has addressed an inquiry to central stations and dealers throughout the country. As a result of the inquiry, it seems that in some cases the breakdowns are due to carelessness in operation. In very few cases were troubles found to be attributable to defective design. It is hardly likely this would be admitted. With irons and vacuum cleaners much trouble is experienced with the wearing-out of extension cords and the breaking-down of sockets from both electrical and mechanical strain. The paragraph is very brief; and it does not touch definitely many of those breakdowns with which users are familiar in this country—breakdowns of electric cookers, kettles, and other kitchen appliances. Perhaps that would not be regarded as being in the interests of present-day efforts in the cause of domestic electrification.

Electric Cooking.

We return once more to the controversy to which the letter from "Pot Boiler" has given rise anent the electric cooking proposition. He submitted various points as to competitive costs reliability, &c.; and what he had to say was so truthful that it has caused much electrical resentment. But "Pot Boiler" was talking from experience; and on that experience, he sticks steadfastly to his views. One of his points was the expenditure of current for effecting certain operations. A critic of his statements in this respect is "Heat Unit;" and he asks rather a striking question. It is: "Were the people who conducted the trials intelligent women or silly maids who would as soon leave a hotplate on at 'high' as not, or who would see no relation between joint shrinkage and current consumption, and who would boil up water in a saucepan instead of an electric kettle?" In that question we have a beautiful commentary on much inane writing in our electrical contemporaries on one or two subjects. One is the certainty of electrical operation. It is said the user cannot go wrong in electrical operation. But, of course, the user can unless the mind is kept concentrated on the work; and then as a rule there are only three or four temperatures to which there can be regulation, and not one may be exactly correct. Whatever the atmospheric temperature—in the winter there are greater losses from an oven than in the summer—the same fixed quantities of energy are all that are supplied. Yet, according to the writings of electrical men, nothing can go wrong because temperatures are fixed. Things do go wrong, not only owing to variable temperatures external to the oven, but through depreciating elements, and, as "Heat Unit" now reminds us, through negligence or oversight. The admission, too, is interesting regarding those people who "see no relation between joint shrinkage and current consumption." There we have a point electrically made of which there has been frequent mention in the "Memoranda"—that shrinkage of joints is entirely a matter of temperature, and not of the heat-producing agent. Heat is heat, whatever its source. Cooks are not the only highly accomplished asses in existence.

Sticking to His Guns.

"Pot Boiler," as we have remarked, sticks to the statements he originally made. Neither he nor many other supply engineers think there has been any answer to the points made in his letter. He holds that electric-cookers which are listed at £20 and £22 cannot be hired-out for 10s. a quarter—the figure covering all interest and depreciation charges, with maintenance. From the point of view of the supply undertakings, therefore, there is nothing very fat in the revenue from hire—in fact, if the charges are properly allocated, there will be a loss. He also submits that it is very doubtful if any electricity undertaking can at the present time afford to deliver current at the consumers' terminals for such a load as cooking at less than 1½d. per unit, even after making all allowances for diversity factor. Where, then, is this cooking business inviting to the electricity undertakings from the commercial point of view? Of course, he believes cooking by electricity to be the correct mode of operation. The cost, however, will be taken into consideration by the bulk of prospective cooking consumers; and to expect the electricity supply undertakings to make a loss on the hiring, and little or no profit on the supply, is asking too much. From his letter one may also conclude that his view is that electricity undertakings have spent much in the effort to cultivate domestic electrification; but there has been no commensurate harvest. He does not think the electric stove makers show so much enterprise in lending a hand in this direction as the gas-stove makers. That may be; but we recognize that the electric-stove manufacturers are up against more difficult problems.

The Price and Service Value.

Service value is a matter which in our opinion should, if at all, be taken into consideration in connection with operating costs of electrical appliances, and not initial costs. But Mr. E. R. Morton apparently thinks service value is a tangible something which, if an appliance improves that value to the user in comparison with something else, should be paid for in the initial costs. Far better would it be for the improved service value to be utilized as a reason for adoption, than for it to be taken into account in raising the initial cost. It will be recollected that "Looker-On" recently analyzed the costs of electrical goods to see where their high cost came in compared with other appliances that compete for the same service. He found that the costs of the electrical parts of the appliances worked-out at far too high a figure. Mr. Morton does not accept all that "Looker-On" had to say; but curiously enough, while generally referring to inaccuracies as to price, he does not specifically show where they are incorrect. But he does admit that the prospects of price reduction are not overflowing with promise. He writes that "in a country where production of electrical appliances has reached an extraordinarily high figure, the cost of a really good washing machine is at least 25 p ct. of the value of a popular motor car. Just how we, in this country, with our considerably limited prospects, can hope to do better, it is difficult to say. I, personally, welcome constructive criticism, and would be only too glad to have such information as would enable appliances to be manufactured and marketed at the prices suggested; but in comparing prices, do let us endeavour to see that the articles compared are at least equal in service value." In this letter there is not overpowering optimism as to lower manufacturing costs and retail prices for electric appliances.

Some Prices.

"Electrical Industries" are now publishing a price list of electrical fittings; and it is rather interesting in connection with the correspondence as to initial costs. The list is "copyright;" but we are not going to publish it—only extract from it a few figures. We see that cookers, double cased, with hotplate and grill, and an oven size 15 in. by 12¾ in. by 13 in. cost £15 15s. As the oven size goes up, so do the prices, until, with an oven 20 in. by 13 in. by 15 in., the cost is £25 to £30. Boiling-rings 6½ in., 700-watt, are priced at 20s. to 27s.; and 7½ in., 1000-watt, 27s. 6d. to 43s. A clothes washer, with wringer, figures at from £30 to £50. Irons are at 21s. for a 4-lb. one, rising progressively to 61s. for a 12-lb. one. Electric kettles can be purchased from 35s. to 90s. each. Motors can be bought at £5 12s. 6d. for $\frac{1}{10}$ H.P.; and larger sizes at increased figures up to £36 for a 5 H.P. size. Those are for direct current. Alternating current ones range from £5 12s. 6d. for $\frac{1}{30}$ H.P. to £31 for 5 H.P.

Loss of Heat.

In previously dealing with the subject of water heating by electric current continuously trickling into immersion heaters in storage tanks, we have referred to the heat losses which are also perpetually going on. Some electricians claim a full 100 p.ct. efficiency for immersion water-heating appliances, which is a claim unworthy of anybody outside an asylum for people with feeble minds. We have also given information as to the plans of the Westminster Electric Supply Corporation for developing a water-heating load by means of electric water-heaters of the storage type. In this connection it is interesting to note that "Electrical Industries" writes as follows concerning this water-heating apparatus: "Although this equipment does not give the high heat-retaining qualities aimed at in some designs, it is claimed to be efficient enough for practical purposes. Actually, it may be an advantage to have a slight steady escape of heat, as it warms the room in which the tank is placed and assists the airing of towels, &c." We prefer a water-heating appliance to give the highest possible efficiency, and do not regard as an advantage anything that contributes to inefficiency.

The "Safety" of Electricity.

Every week we read accounts of fatalities due to electric shocks, as well as of other troubles. But the electricians, with well-stimulated innocence, persistently speak of the "safety" of electricity. Last week an instance of the so-called safety was given in connection with the tramway accident in the Potteries. The primary cause of the accident was the fusing of the electric wires, which caused a "blow-out" in the control box on the driver's platform. Smoke and flames were thrown out; and the driver states that he attempted to shut off the current and so check the speed of the car by operating an overhead switch. As he was endeavouring to do so, however, he overbalanced himself and fell off the platform into the road. He tried to overtake the car, but could not do so owing to the speed it had gathered while travelling down a steep gradient. The car proceeded driverless at a terrific speed, and, failing to negotiate a sharp curve, left the metals. Eighteen persons were hurt.

On the occasion of the Lyons Fair in the spring of next year the East Central District Office of Agriculture have decided to organize public trials of tractors driven by gas-engines using gas of a low calorific value, such as that generated from wood, charcoal, &c. Lorries, domestic motors for farms, and small motors of all kinds, will also be seen at the fair.

AMERICAN GAS INDUSTRY ORGANIZATION COMPARED WITH BRITISH METHODS.

By ALD. FRED J. WEST, C.B.E., M.I.Mech.E.

[From the "Bulletin" of the Society of British Gas Industries.]

AT a recent meeting of the Council of the Society of British Gas Industries, I related briefly the impressions gained when attending the American Gas Convention at Chicago in November last. My remarks were chiefly directed to a comparison of American methods with British. In the result, I was asked to write a short article on the subject for the "Bulletin."

Comparisons are sometimes said to be odious; but I submit that it is highly instructive to contrast the present practice in Great Britain, in connection with the organizations of the gas industry, with that followed in the United States. And let it be said at once that the main purpose of this article is to emphasize the weak points of our present practice, the need for co-ordination of interests, and the advantages to be obtained by an amalgamation or linking-up of the present separately operated units into one capital organization.

THE WELDING OF INTERESTS IN AMERICA.

The formation of the present representative American Gas Association has been a gradual process. The American Gas Institute was formed in 1906 by the amalgamation of the American Gas Light Association (originally organized in 1873), the Western Gas Association (organized in 1877), and the Ohio Gas Light Association (organized in 1901). The National Commercial Gas Association, which was formed in 1905, was the first departure in the way of an organization of the purely commercial side of the gas business in the United States. It rapidly grew in membership, became an active and powerful organization, and did much to advance the commercial development of the gas business during the thirteen years of its life. Throughout this period the American Gas Institute held undisputed sway as the national organization representing the engineering and technical side of the business. About 1911 or 1912, however, there began to be talk in favour of the amalgamation of the two Associations, so as to have but one national organization in the country. Such a plan had many advantages; but there was also considerable opposition from both the technical and commercial sides. As time passed, however, the objections became less pronounced; and with the impetus given by war conditions, the added need for economy, &c., the long discussed amalgamation took place in June, 1918.

Thus it was that in the year named the present American Gas Association came into being, and successfully welded together the several then existing organizations in the United States. It is generally agreed that the gas industry there is now provided with a well-organized and powerful central operative body, which can also act in a representative capacity as occasion demands.

The Association is sub-divided into several sections as follows:

Accounting Section.
Advertising and Publicity Section.
Commercial Section.
Technical Section.
Manufacturers' Section.

The work of the Association as a whole, and its general and sectional activities, are in the closest co-ordination. Each section is in touch with the work the others are doing; duplication of effort is being avoided; and non-essential work is being eliminated to the greatest possible degree. In short, the Executive Board and Management of the American Gas Association are endeavouring to conduct its affairs with the same degree of efficiency and thoroughness that would govern the administration of any progressive, successful business enterprise.

PROCEEDINGS AT THE CONVENTION.

Now a few words relative to the convention itself. The various general and sectional meetings covered three full days. In the morning each day, a general session was held, when the President's address and other addresses were given, followed by discussions on subjects of general interest to the members. Reports of general committees were also submitted. In the afternoon each day, the several sections met separately, reports were presented, and addresses and discussions on subjects of specific interest took place.

A matter of particular interest to the members of our Society, and which testifies to the recognition of the mutuality of interests, is that concurrently with the meeting, and in the same building, a manufacturers' exhibition was held, comprising approximately 100 stalls or exhibits.

The meetings were well attended; and a wide range of subjects was covered at the general and sectional sessions. My main impression was to the effect that the Americans had with broad-mindedness successfully solved the problem of uniting, in one central organization and in one annual meeting, the respective and varied interests of the gas industry. And the cordiality, kindness, and courtesy to a visitor from Great Britain from the many whom it was his privilege to meet, could not be surpassed, and could never be forgotten.

WHAT HAS BEEN DONE THERE COULD BE DONE HERE.

Space and time will not permit of a more detailed description of the many aspects and outstanding features of the meeting; and it now only remains to be asserted that what the gas industry in the United States has achieved by the consolidation and co-ordination of its many interests could be developed in this country on, probably, even a more successful and comprehensive basis.

HIGHER EFFICIENCY BY CO-OPERATION AND CO-ORDINATION.

It would savour of lack of appreciation to belittle in any way the extremely useful work performed in the past by the existing organizations in the British gas industry. It can be said without fear of contradiction that they have all more than justified their existence, and have advanced to a state of high efficiency in our various and complicated interests. But there is now overlapping; there are too many divisions into watertight compartments; there is conservatism and suspicion; and the time of principals is too much occupied in attending meetings.

THE TAX OF MANY MEETINGS.

On this last-named point, it is well known that boards of directors and municipal committees are frequently diffident about granting permission to their principal officials to attend the annual meetings of this or that association—diffidence which is often actuated by want of recognition of the great advantage to be obtained by doing so. It must be admitted, however, that the constant claims and demands on the time of the principal officials of many gas undertakings to attend the several annual meetings of our three or four existing main organizations, together with a host of committee meetings—to say nothing of district meetings—justify some protest from those whose privilege it is to grant these facilities.

Take, for instance, the position of affairs in 1921. There are no less than five principal organizations (excluding all district associations, the Sulphate of Ammonia Federation, and the Benzole Association) which hold their annual meetings at various times, and in places as far apart as Glasgow and London. The following is a list of them:

1921.	Place of Annual Meeting.	Month.
Institution of Gas Engineers	London	October (Normally June)
National Gas Council	London	December (June in future)
British Commercial Gas Association .	Glasgow	September
Gas Companies' Protection Association .	London	November
Society of British Gas Industries . . .	London	October (Normally May)

And it must not be overlooked that, except in the case of the larger gas undertakings, the same official is frequently expected to represent the case of his particular undertaking at each meeting.

A VALUABLE LESSON.

Not the least of the outstanding and valuable lessons from the war is that of the advantages to be obtained from the concentration of effort, the grouping of interests, and the co-ordination of aim and object. The war found the gas industry inadequately represented on matters of national importance, and new organizations sprang into existence, which, under able leadership, accomplished great things. But the time has surely and opportunely arrived when the need for re-organization of our many interests has very definitely asserted itself. It is not a time to suggest that any one of the existing organizations is unimportant, and can be dispensed with. I deliberately assert, however, that it is a time when all should be bonded into one central and head organization, in which the various interests of our great industry would be re-organized and catered for.

This is not by any means a new gospel or theme. Many voices have been "crying in the wilderness," advocating this doctrine for some time past. The cry is more insistent than ever; and it behoves the leaders of the industry to grapple with a problem admittedly difficult, but quite capable of satisfactory solution.

Many of the foregoing points were excellently covered by Sir Arthur Duckham in a contribution to the "Bulletin" last year, which was reprinted by the "GAS JOURNAL" in their issue of July 20, 1921, together with a trenchant and well-written "Editorial" on the subject.

POSITION OF CONTRACTORS AND MANUFACTURERS.

Thus far I have refrained from commenting on the invidious and isolated position occupied by contractors and manufacturers under the present state of affairs. Much has been written, and could be written, upon this deficiency, which is detrimental to the best interests of the industry; and it is a subject upon which the writer and others feel keenly and sorely. No useful purpose, however, would be accomplished by the opening of old sores, supplemented by recriminations on the mistakes of the past; nor is it the intention in a last subtle paragraph to introduce this vexed question as the main point for solution. But let it be said—and I say it with a full consciousness of its truth—that our important side of the industry is willing and anxious to devote its best talents, brains, and influence to a problem which is capable of successful solution in a manner and on a basis which must undoubtedly lead to greater efficiency and the establishment of the industry on a broader and sounder basis.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

Annual Meeting in Ayr—Thursday, Sept. 7.

THE Annual Meeting of the North British Association of Gas Managers was held on Thursday last, in the Town Hall, Ayr. Mr. C. W. FAIRWEATHER, of Kilmarnock, who occupied the chair, was supported by Mr. J. M. Smith (Stirling), and Mr. David Fulton (Helensburgh), the Secretary and Treasurer. Upwards of 100 members were present.

PRESIDENT'S WELCOME.

The PRESIDENT said he should like at the outset to welcome the members to the old town of Ayr. Favoured as they were with delightful weather, they would find that the burgh of Ayr possessed many and varied attractions. It was to be feared that a number of those present had not so far participated in the ballot for the election of office-bearers. It was essential that they should have as officers of the Association men who had the confidence of the majority of the members, and for this reason he appealed to those in attendance to exercise their voting privilege before leaving the hall.

THE COUNCIL'S ANNUAL REPORT.—See *ante*, p. 469.

The PRESIDENT, in moving the adoption of the report, made kindly and sympathetic reference to the death of those whose names figured in the obituary list. It would be noticed, he said, that there was a slight decrease in membership, but with the nominations and admissions to be made that day the numerical strength of the Association would be fully maintained.

The adoption of the report was unanimously agreed to without discussion.

NEW MEMBERS.

The SECRETARY (Mr. David Fulton) intimated that nomination for membership had been made on behalf of the undernoted gentlemen: *Ordinary members:* Messrs. Allan Young, of Tayport; J. Perry Thomson, of Newmilns; Alexander M. Keillor, of Tillicoultry; Jas. Young, of Girvan; Archd. D. Caulbrough, of Alyth; Robert Brown, of Catrine; and A. L. Rule, of Dingwall. *Extraordinary members:* Messrs. James Nicol (Messrs. Jas. M'Kelvie & Co.); George A. Mitchell (Messrs. J. Milne & Son); Frank Richmond (Messrs. The Richmond Gas Stove Company); Frank Watt (Glasgow); P. Baxter (Barrowfield Ironworks, Glasgow); and Allister C. Watson (Newton Stewart).

The admission of the foregoing gentlemen as members of the Association was agreed to.

THE PRESIDENT'S ADDRESS.

The routine business of the Association having been disposed of, the PRESIDENT thereafter delivered the following address:

THE AFTER-EFFECTS OF THE MINERS' STRIKE.

Since the last annual meeting of the North British Association of Gas Managers in Perth, the gas industry has passed through quite a difficult period, due to several causes. One of the outstanding difficulties which was experienced was the after-effect financially of the miners' strike, which began on April 1 and ended on July 4, 1921. Then there was the serious fall in the price of residual products, which was to be expected certainly, but which was unfortunate in this respect—that the fall in the price of residual products was proportionately much heavier than the fall in the cost of coal and other raw materials. The cost of coke, for instance, fell to about half its peak price during the war period. This was also the case with regard to sulphate of ammonia; while crude ammoniacal liquor could not be disposed of except at a loss to the seller, and the tar market was nearly as bad. Against all these factors the price of coal dropped very slowly in proportion, and this over a prolonged period.

Then, to add to these financial difficulties, as already stated, the adverse effects of the miners' strike became apparent to all gas companies and corporations who closed their books at the usual May period. In many places where very large stocks of coal had been held, the difficulty did not bear so heavily; but all undertakings who had to purchase coal in order to carry on business during the strike, had to pay ransom prices. Thus very small concerns, who could not afford to pay the prices paid by the larger undertakings, had to close up altogether. From their point of view, undoubtedly this was the preferable course, as carrying-on meant ruin.

Since the war period, there has been a tremendous change in the business of gas manufacture. This has been apparent both to the manufacturer and the consumer; but I think that, during the miners' strike period, the resource and ingenuity shown in the endeavour to carry-on business indicated an exceedingly healthy state of vitality. All sorts of make-shifts were resorted to by gas companies in order to supply consumers with gas, so that domestic life might be carried on in the complete absence of coal supplies. This only proves once again what is already so well known—that it is the emergency which provides the opportunity. In this connection it may be noted how quickly a situation changes; and companies and corporations who had been put to vast expense in endeavouring to see their consumers through the coal strike period, at the first convenient opportunity are being peremptorily requested to reduce their prices for gas, notwithstanding the adverse conditions already described. Public popularity is proverbially short-lived.

Under old-fashioned normal methods of gas supply, in pre-war days, gas manufacture was an exceedingly routine matter; but now every day brings a new problem, with the result that even to-day the gas industry of the country is in a transition stage, though gas lighting was introduced as a national necessity more than one hundred years ago.

EARLY HISTORY OF THE KILMARNOCK GAS-WORKS.

It is interesting, on looking back over the history of the last hundred years or so, to note the changes which have occurred. This has been brought particularly to my own notice through the fact that in June last the centenary was celebrated of gas lighting in Kilmarnock; and, strange to say, it was also the jubilee of the supply of gas to the community by the Kilmarnock Corporation. The first meeting to constitute the Kilmarnock Gas Light Company was held on June 25, 1822, and at that meeting a circular was authorized to be issued to the community, reading as follows:

> Amongst other improvements connected with the town of Kilmarnock, it has been suggested that the introduction of the gas light would prove highly beneficial, cheap, and ornamental to the place. The gentlemen favourable to the object of improvement, after consulting the magistrates, who approved of the scheme and promised their support, resolved to open a subscription to carry it into effect; it being understood that as soon as a respectable number of subscribers shall have come forward, a general meeting shall be called, and the probable expenses laid before the subscribers, when a committee of management shall be appointed.

The first regulation of the Company in their Articles also states:

> The Company shall be denominated the Kilmarnock Gas Light Company, having for its object the lighting of the public lamps of the town of Kilmarnock, or private houses, or shops, counting-houses, or warehouses, or other places within the said town, under an agreement with any person, or persons, or bodies politic, corporate, or collegiate, willing and desirous of contracting with the said Company for the lighting thereof with gas.

Quite a pretentious regulation!

That was in June, 1822. Then in June, 1872, the gas undertaking belonging to the old Company was purchased by the Corporation; so that the three dates of June, 1822, June, 1872, and June, 1922, are unique in the history of gas lighting in Kilmarnock. This was recognized by the Corporation, who celebrated the occasion in a fitting manner, and had a bronze panel setting forth these historical features inserted in the hall of the offices at the Riverbank Gas-Works. At the same time, a Roll of Honour was unveiled by the Provost of the burgh, giving the names of those men in the service of the Gas Department who joined the Colours during the war.

In going over the old minute books of the Company, it is most instructive to note the original methods of gas supply which were put in force. The method of gas supply was originally a contract between the consumer and the Company, by which the consumer was entitled to use a "rat-tail" flame 4 in. high from sundown up till 10 o'clock p.m. To regulate this, watchers were appointed by the Gas Company to supervise and see that the lights were extinguished at the proper hour. In the old Sub-Committee book interesting minutes still show how well-known citizens at that time were reported for either burning their light beyond the proper hour or using a burner giving too long a flame; while numerous consumers were reported for giving insolence to the gas surveyor and collector. This latter class was divided into two sections—*i.e.*, "first offence" and "old offender." A favourite method adopted by the Kilmarnock Gas Sub-Committee in dealing with an offender in the days of rat-tail consumption, after repeated offence, was an instruction to the Manager to "shut his pipe" or, in modern language, to discontinue the supply of gas to the consumer.

The progress of the construction of the gas-works was supervised by a Sub-Committee, who appeared to take a practical interest in the details of the construction; and it is on record that they ordered a bore to be put down to determine the nature of the sub-soil, for the construction of a tar tank 12 ft. deep. As time passed on, methods changed; and the first twenty-four wet meters were ordered on April 1, 1828, at a price not to exceed 35s. each, from Milne's (or, as it is spelt in the old minute book, "Mill's"), of Edinburgh. The gas to be passed through these meters was to be charged at the rate of 13s. 6d. per 1000 c.ft. The City of Glasgow, however, had anticipated Kilmarnock in gas supply, for it is set forth that a deputation of the Directors of the Kilmarnock Gas Company was appointed to visit Glasgow and inquire into the methods in force there on certain points.

The affairs of the old Company succeeded so well, and the

business had become such an asset to the town that, as already stated, the Corporation acquired the undertaking in 1872, and since that time the business of gas supply in Kilmarnock has been developed by the Corporation to its utmost extent. It may be noted that the manufacture of crude naphtha, as well as sulphate of ammonia, in Kilmarnock is of very old date; and I have heard it stated—though I cannot vouch for the accuracy of the statement—that Kilmarnock was the first gas-works in Scotland to manufacture sulphate of ammonia. That was in the day of Mr. W. G. Walker, the Manager, who afterwards founded the business of Messrs. W. G. Walker & Sons, Tar Distillers, of Ayr.

When the gas-works was acquired by the Corporation, the annual consumption was 28 million c.ft.; while in the year just closed the consumption in Kilmarnock had risen to 289 millions. In going over the old records, the thought is borne in upon one—what a tremendous change has taken place!

The old methods were sound, and served their day well. But in these past days the gas was used itself as a primary lighting medium. To-day it is employed simply as an accessory, in order to heat-up a certain substance to a state of incandescence; while in the case of heating, &c., the introduction of the bunsen flame revolutionized the original conception of gas as a medium of domestic utility. Then secondary, or residual, products were originally a source of little or no revenue; while to-day one might almost say that the efficient production of residual products is a matter of primary necessity in a gas-works. We have known cases where retorts were heated with gas or tar in order to save coke, the condition of the market controlling the method.

DEVELOPMENTS.

At this juncture, I would like to add some little information regarding the development of gas supply in Kilmarnock, and the constantly changing conditions which affected the conduct of the business by the Municipality. The explanation of the methods which have been adopted to meet certain difficulties may be of assistance somewhere. In 1901, the Corporation of Kilmarnock obtained parliamentary powers to proceed with the erection of new gas-works at Riverbank, situated about 1·3 miles from the Langland Street works, which were originally founded by the old Gas Company. The site of the old works had become too restricted, and, moreover, this part of the town is now a thickly populated dwelling place for workmen engaged in engineering. Further, the old works had no satisfactory siding accommodation, and the process of gas manufacture was being carried on in a stultified manner.

The construction of the first section of the new works at Riverbank was commenced and set to work for gas-making purposes as a relief station in 1904. The plant at Riverbank was gradually extended, until the whole gas manufacturing operation was transferred there, and the works were formally inaugurated in March, 1910. Since that date, the whole operations of gas manufacture have been conducted there; the old site at Langland Street being used only as a distributing station, where two gasholders, with the necessary governors, are installed to supply two sections of the town. The third section is supplied from Riverbank.

The Riverbank works are equipped with the necessary railway siding accommodation, and are situated in a low-lying part of the town, very conveniently placed for the purposes of gas supply. In addition—as the members of the North British Association of Gas Managers will recollect—the sites of the gas and electricity works are adjacent; so that the handling of coal and all railway in-going and out-going supplies is jointly done by the two Departments, which results in a very considerable annual saving. It is interesting to note that to begin with the gas could be supplied from either works by loading one set of governors so that those at the other end were automatically closed, the gas supply to the town meantime being satisfactorily maintained by a system of valves. This was a very convenient arrangement in its day, and saved some pumping of gas. Within the last ten years, however, the ratio of supply as between the two stations has so altered that this device has become unsatisfactory, because, when a departure is made from the normal method of supply, certain large consumers are immediately affected; and the position is that we now no longer utilize this convenient arrangement. Before we could do so now, some of the sections of the gas-mains in the streets would require to be enlarged.

AN INTERMITTENT VERTICAL RETORT INSTALLATION.

The original works at Riverbank were equipped with horizontal retorts in through settings of eight retorts each. This method of manufacture was continued up to the year 1914, when intermittent vertical retorts were put in operation; the installation consisting of sixty intermittent vertical retorts, each retort being 16 ft. 6 in. long. Kilmarnock had a definite object at that time in deciding to adopt intermittent vertical retorts. In Ayrshire, and round about Kilmarnock district, there is a considerable field of coal of a low quality, consisting of low-grade shale, cannel coal, &c.; and some qualities of these materials have been bought at as low a price as 3s. 6d. per ton at the pit. In those days, coke was a very poor asset; and it was considered then that it would be wise to put in carbonizing plant to deal with this grade of material. Hence the decision to adopt intermittent verticals.

The war, however, very quickly swept away the old conditions, and established new ones. Gas coke immediately assumed a position of first-class importance. Particularly during the war, the demand for gas coke was insistent, and, of course, prices were good. Again, the particular industrial conditions from the year 1914 up till the year 1918 were such that a poor class of coal was just about as costly as a first-class coal. Therefore it paid to obtain the best class of coal possible, quite apart from its initial price. The working of a good coal was valuable from the point of view of the price available from the resultant coke. Hence, in Kilmarnock, the original purpose of the installation of the intermittent vertical retort system has disappeared; and it now pays to use a good class of coal. As we all know, gas coke is a most important and valuable residual.

It was known, of course, that steaming in intermittent vertical retorts was altogether a different proposition from steaming in continuous vertical retorts; and it is here that the great pull of continuous methods of carbonization obtain. Steaming in continuous vertical retorts is a constant process, and carried out under constant conditions of temperature, &c. The problem is a very different one in the intermittent process. Intermittent vertical retorts are completely loaded-up with green coal; and the work of carbonization begins when the temperature of the coal has risen sufficiently. After the coal gas has been evolved, steaming is resorted to for (say) two or three hours at the tail end of a charge; but, as is at once apparent, this method does not embody the ideal conditions of continuous steaming.

BLUE WATER-GAS PLANT.

For this reason, the Kilmarnock Corporation decided to do their steaming apart from the intermittent vertical retorts altogether; and for this purpose, a Humphreys and Glasgow blue water-gas plant was installed. This was set to work on Nov. 10, 1921, and has been working most successfully since. There were several conditions connected with the introduction of the blue water-gas plant which may be of interest.

The main feature was the decision of the Corporation to instal the blue water-gas plant, but not to equip the scheme meantime with a relief gasholder. A relief holder of 360,000 c.ft. capacity is available at the Langland Street site, about 1·3 miles away; but this would mean the laying of a connecting main for the whole distance, and, with prices as they were, it was not thought wise to incur this expenditure. The question, therefore, was what would be the result on the regularity of the quality of the gas for town supply without the use of a relief gasholder?

It was decided to manufacture the blue water gas as and when required, and to deliver it into the gasholder at the Riverbank Works, which would thus become a mixing chamber for the coal gas and the blue water gas. Two sets of exhausters were available from the discarded plant formerly at Langland Street, and these were utilized as pumps to draw the gas from the single holder at Riverbank, and to deliver it into the two holders at Langland Street. By this means of constant circulation, it was reckoned that the quality would be maintained with nearly the same regularity as with the use of a relief gasholder, which, it must at once be admitted, is the ideal method.

Another feature of this arrangement was the possible effect on the exhausters of the intermittent working of the water-gas plant. It is essential, of course, that exhausters maintain constant working conditions in a hydraulic main through which coal gas is passing; and if a disturbing element is introduced whereby exhausters have suddenly to deal with an augmented flow of gas, quickly rising (say) from 30,000 c.ft. per hour up to 70,000 c.ft. per hour, the efficient working of the supply is, therefore, endangered. With a "blow" period of 1½ minutes, and a gas-making "run" of (say) 4½ minutes, the working of an exhauster is rendered constantly erratic. With the help of a relief gasholder this state of affairs does not arise, because the exhausters draw in a steady volume of blue water gas at the hydraulic main, and working conditions are constant always.

Taking everything into account, it was decided to deliver the blue water gas into the exhauster outlet. This arrangement has been most efficient, and has avoided the necessity for the water-gas passing through the exhausters and upsetting their steady working. It is surprising with what ease and efficiency a good exhausting plant will work against a varying back-pressure, because that is what the delivery of the water gas into the exhauster outlet means. We do not find any appreciable variation in the working of our coal-gas retorts, because any deviation is at once taken-up and immediately dealt with by the retort-house governor controlling the coal-gas hydraulic main. An efficient governor equipped with a reliable steam regulator so controls the working of the exhauster that an immediate rise from 10 in. back-pressure up to 20 in. back-pressure is easily dealt with; but, of course, the exhausters must be sufficiently large for the purpose. With this method of working, the only drawback lies in the fact that the blue water gas cannot be drawn into the hydraulic main and mixed with the hot gas there, which would be a substantial advantage. With a relief holder this arrangement is the natural one. Another point of interest in our arrangement lies in the fact that we can deliver gas by means of the exhausters to the holders 1·3 miles away. But, as a rule, for the purposes of efficient mixing, we prefer to use the gas-pumps. A safety device, resembling a loaded safety valve on a bye-pass pipe between the gas-pump inlet and outlet, is introduced in connection with the pumps, so that, in the event of a telephonic breakdown (as has occurred) when the gasholders at the distant station are full, the operator at the distant station, when the gasholders are on the point of "blowing," can shut-down the valve there. Meantime the pumps can be travelling, and simply bye-passing through the loaded valve the gas which is being handled,

These devices were found to be necessary in order to ensure reliability of the scheme.

CARBURETTING WATER GAS AS REQUIRED.

Another feature in connection with the water-gas plant is that while the plant was installed by the makers, Messrs. Humphreys and Glasgow, Ltd., as a water-gas plant, we have introduced an oil supply into the generator, for the purposes of carburetting, when we require it, a certain amount of water gas. This is an exceedingly useful accessory; and we can use with ease and reasonable economy a quantity of oil up to half-a-gallon per 1000 c.ft. of blue water gas produced. I dare say we shall add a carburettor, and a superheater, tar separator, &c., in time; but at present we are carrying on in this way with satisfactory results.

We spray the oil on to the hot coke within the generator on the down run of steam for a period of about two minutes, shutting off the oil for about one minute before the down run of steam is stopped, in order to clear as much of the oil gas as is possible before the blow period starts. At the present time, the combined results of coal gas from intermittent verticals, blue water gas, and the necessary amount of oil gas required for the carburation of the blue water gas, amounts to about 16.500 c.ft. per ton of coal carbonized, and is a gas of 450 B.Th.U. gross. The comparatively small amount of oil gas tar which we are recovering is used mixed with low-grade coke breeze for the boilers for steam raising purposes, rather than mixing it with the coal tar and running the risk of depreciating the quality of the dehydrated tar manufactured for the purpose of roadmaking.

"A. AND M." PRESSURE WAVE-CONTROLLERS.

Generally speaking, the foregoing are the outstanding features within our works. In the distribution department, the most recent improvement has been the introduction of the automatic lighting of public lamps by means of the pressure-wave system. We commenced to instal this system about two years ago, and have gradually added to it until the whole town is now fitted with it. To govern the gas supply to Kilmarnock, as already stated, we have three governors controlling a district each, and when the "wave" is applied either for lighting or extinguishing the public lamps, it is done from each of the three governors simultaneously. The governor bye-passes on two of the district governors are opened, and holder pressure is admitted to the town, running up to 5½ in. water. At the same time, a steam booster, or, alternatively, gasholder pressure through the bye-pass valve, is applied at Riverbank, and a pressure wave of 6 in. water is sent over the whole area, and either lights or extinguishes the public lamps as required. There are very few failures, probably on an average about 1 p.ct., and these are accounted for by temporary defects, such as faulty bye-passes or chokes.

Each individual lamp is loaded for its own particular situation; and the system has proved so satisfactory that it is now safe and reliable. The various districts of the town were tested for their pressures, and each burner-nozzle is so rated as to give as near as possible a burner consumption of 3 c.ft. per hour, at the particular pressure of the individual lamp. Instead of having ten lamplighters, as formerly, for 1100 public lamps, we have now three men for 700 public lamps—in fact, we might do the work with two men, only we spend a large part of the third man's cost in ensuring frequent and thorough cleaning of the lanterns. The particular apparatus used by us is the "A. & M." system, as manufactured by Messrs. Alder and Mackay, Ltd., of Edinburgh.

The original arrangement of lamps in Kilmarnock in pre-war days had been laid down for the old system of flat-flame lighting. When, however, the Corporation decided to adopt the pressure-wave system, the lamps were rearranged, and the number cut down to the figure given; and the lighting of the town is better. I consider that a most important feature in efficient public lighting is clean lanterns. If these are kept in a state of constant cleanliness, great economy can be effected in the number of lamps used; and this is the principle upon which we go—cutting down the number of lamps to the minimum, but ensuring ample and efficient cleaning.

INCREASED CONSUMPTION PER CONSUMER.

Another interesting feature regarding the gas supply of Kilmarnock is a comparison of the output of gas year by year since the Electricity Department started; and it is surprising to note that during all these years the population of Kilmarnock has been practically stationary. That is to say, the additional consumption has been taken out of the same number of consumers simply by endeavouring to give an efficient and economical service.

The war period, of course, interfered with the routine of our business, as it did with all other businesses; but, still, the figures given below are illuminating. Regarding the figures for the annual output of the Electricity Department, it should be stated that the Kilmarnock Corporation have now a very large area of the County of Ayrshire for electricity supply, so that the undertaking is a county as well as a burgh supplier; and this accounts for the phenomenal annual increases in electricity output.

The comparison is shown in the accompanying table.

It will thus be seen that since 1905, when the Electricity Department in Kilmarnock began, the output of gas has nearly doubled, and is still continuing to increase in a satisfactory manner.

Year.	Gas Manufactured.	Electricity Generated.
	C.Ft.	Units.
1905	163,354,700	236,259
1906	164,136,000	585,088
1907	168,431,000	628,736
1908	169,882,000	754,329
1909	164,317,200	794,211
1910	175,325,500	836,800
1911	186,194,000	887,068
1912	189,332,600	1,199,530
1913	204,727,900	1,687,505
1914	211,056,700	2,655,248
1915	222,286,100	2,736,430
1916	226,500,000	6,011,735
1917	230,019,990	10,002,714
1918	240,791,000	12,763,587
1919	238,187,300	14,364,960
1920	261,494,200	15,450,391
1921	273,168,400	20,006,240
1922	289,000,000	17,333,660

MEETING COMPETITION.—SATISFYING CONSUMERS.

It is, however, a fact that selling gas now is a much more expensive thing for gas undertakings than it was twenty years ago. At that time the sale of gas was largely for lighting, and, moreover, gas companies had a monopoly. Therefore, they could, within certain limits, not only sell the gas in the way it suited them best, but it was not so necessary then to encourage the sale as it is to-day. In the face of severe modern competition, gas undertakings necessarily require to encourage their consumers to use gas freely; and this is done by means of the cheap hiring of gas heating and cooking appliances of all kinds. Kilmarnock, like other places, has had to adopt this policy; and now we have an average of about one appliance per consumer, whether it be a cooker, heater, or a simple gas-ring. Necessarily it is costly to do this; but it must also be recollected that a consumer using a gas-ring is probably worth three average lighting consumers. Hand in hand with this policy is the necessity for the reduction of the price of gas, so that consumers may use it prodigally, or at least freely, for domestic purposes. I am quite convinced that there is still a wide field within which we can operate. As the affairs of the country stabilize, and the present difficult and straitened circumstances pass away, and costs again become more normal, the effect will be that gas companies, like other traders, will be able to reduce the price of their wares, and thus extend the scope of their business as public utility undertakings. It must be remembered, however, that as the years pass, electricity supply bodies are equally alert, and while at the present moment gas as a domestic agent, especially for heating, cooking, &c., is much cheaper, it does not follow that the present ratio will always hold. Thus it is essential that every endeavour should be made to manufacture gas at the cheapest possible rate, because, after all is said and done, it is the cost to the consumer which is the potent factor. If electricity supply bodies can, in the future, supply current at cheap rates for these domestic purposes, then gas undertakings will be seriously embarrassed.

As part of the modern policy of a gas undertaking, there should be paid very special and careful attention to the efficient distribution of gas. The economical production of good gas is necessary; but that is only half the tale. It still remains for the gas company or corporation to hand that gas along to the consumer in a manner acceptable to him; and the responsibility of a gas undertaking does not cease until the consumer pays his gas bill as a thoroughly satisfied purchaser. I am quite aware of the difficulties involved in satisfying gas consumers. Where one has a large population to deal with as clients, one has varying needs and conditions to provide for. All the same, it should be part of the policy of an up-to-date gas undertaking to go out among consumers, and act in co-operation with them, and show them, by efficient service, that it is the desire of the gas supplier to see that his customers are satisfied, just as it should be the desire of a good tailor to satisfy his particular patrons, and prevent them straying elsewhere.

The Kilmarnock Corporation endeavour to carry out this policy as far as the necessities of their own case demand. As an illustration, I may state that about six months ago we had a case of gas poisoning in which, unfortunately, two women occupying the same room were found dead in bed. On investigation, it was discovered that the prepayment meter serving this particular house had been moved from its proper position by the shaking of the pennies through the prepayment mechanism. This had gone on for some time, with the result that a joint at the meter inlet in front of the meter stopcock had been sprung; and it was evident that the leak had been repeatedly patched up with soap. On the fatal night, however, when the women were overcome, the soap had dried and cracked away, and ere morning the women were dead. Now several things were involved in the circumstances leading up to the actual tragedy. One important factor was the cost to the proprietor of the house of all classes of repairs. The fact was that in very many cases no repairs were executed, and, in the particular case under review, the late consumers' next-of-kin claimed that they had advised the factor of the leak in the proprietor's pipes; but no intimation had ever been made to the Gas Department. However, the proprietor did nothing to cure the leak; and the consumer, being a poor person in straitened circumstances, would not spend the money. Therefore, a temporary patch was made, which gave out, as already stated, with fatal consequences. Again, at the time in question the gas rate was high, with the result that many coins were passing through prepayment meters; and thus the risk was further extended.

The Gas Committee of the Kilmarnock Corporation took the whole of the circumstances into account, and they faced the situation that, while no blame was attributable to the Department, such things ultimately besmirched their reputation as the sellers of a commodity recommended as useful, safe, and economical to the community.

INSPECTION OF CONSUMERS' FITTINGS.

We now inspect fittings among all classes of consumers, but particularly in the poorer localities where the prepayment meter is so common, and where it is subject to the utmost conditions of wear and tear. Our inspectors are constantly passing among consumers, and reporting not only on the condition of the fittings belonging to the Gas Department and appliances on hire, but also on the condition of the proprietors' fittings, over which we as a Department, of course, have no control. We now take up the position that where a proprietor's fittings are out of repair to such an extent as renders continued supply dangerous, we ask that the defect should be rectified—otherwise we discontinue the supply of gas. We do not propose in any way to relieve a proprietor of his risk and assume it ourselves. Therefore we do not interfere with a proprietor's fittings, but we ask that he should have everything in a sound condition before we will guarantee a supply of gas. We claim that a method such as this ensures safety to the consumer and satisfaction to the supplier; and while it may not be possible to protect some classes of consumers from themselves, still we consider we are doing everything possible towards this end by adopting the foregoing methods. Cases of gas poisoning may be attributable to the neglect of a consumer or of a house proprietor; but, at the same time, the constant repetition of gas poisoning cases reacts very unfavourably on the reputation of gas as a safe and useful commodity. While it costs more to ensure safety, I think the cost should be freely undertaken, if the prosperity of the industry is to be maintained. This is just another illustration of what I formerly stated—that it is a more costly thing to sell gas to-day than it was twenty years ago.

MAINTENANCE.

In this connection, I think gas companies in the future are bound to give more consideration to the maintenance of burners, mantles, &c. There is no doubt that many a grumble to the gas company of bad gas is simply the fault of a dirty burner or worn-out mantle; and gas consumers, in many cases, are extraordinarily careless on such matters. They will cleanse with the utmost care and regularity the dining utensils of the household, but a gas-fire or a burner are things they would never even dream of cleaning; and when the light fails, or the cooker does not operate freely, a complaint is sent in to the gas department about bad gas. Of course, to stretch the point still further, one can understand that at some date a consumer may discard the use of gas on the score of its being bad, and substitute for it electricity. Now, in the keen competition of modern times, no gas company can afford to lose consumers in this way. Therefore, I am forced to the conclusion that before long, if we are to maintain what we at present hold, dealing in lighting appliances will become a part of our business also.

A WORD ABOUT QUALITY.

While discussing the question of the up-to-date sale of gas, a word may be added regarding the up-to-date quality of gas. We, as gas engineers, are to-day agreed that the proper gas for modern conditions is a gas supplied as a heating agent, apart altogether from its luminosity. We also know the recent changes which have come to pass in the consistency of gas, and the endeavour of gas undertakings to supply the right gas for the specific purpose. Undoubtedly, modern gas is a different gas to measure than was the old yellow gas rich in hydrocarbons; and I am quite sure that this is having an effect on the registration of gas by dry meters. At present we have the position under observation, and our surveyors are instructed to note all cases where they are dubious of a meter registering the full amount of gas consumed. Of course, it may only be inference on the part of the surveyor to suppose that a meter is not accurately registering all the gas passing through; but at least it is an inference well worth following up, which we propose to do. With the 20-candle power gas at one time supplied, lubricants were carried through the meter which maintained the leather work of the diaphragms in a pliable condition. The point which we are watching just now is whether the gas which we are supplying to-day has a drying effect on the leather of the diaphragms, and thus retards correct registration. I really cannot, at present, say much about the position; but I can only remark that it is one well worth watching, because a considerable amount of revenue may be lost through individual meters not registering correctly. In the case of one meter which came within my notice the other day, a light of 2½ c.ft. per hour could be maintained without the meter registering at all. Generally speaking, therefore, the reports of our surveyors have led us to wonder if the registration of our gas of to-day is exactly on all fours with the measurement of gas fifteen or twenty years ago.

METER CAPACITY.

In this connection, it is now most important that all consumers' meters should be of ample capacity. There is no doubt that gas undertakings suffer in many individual cases where meters are too small for their work. It is too costly, of course, to replace meters wholesale for this purpose; but in all cases where a meter is discarded, the new one should be large enough for the consumer's requirements.

THE THERM BASIS.

All consumers, in the near future, will pay for their gas in accordance with its thermal value; and this should be a reasonably simple process. Much comment is being made to-day, particularly in the South, regarding enhanced bills through the change; and, without knowing the exact facts of the case, I can only fancy that this will be caused through bad balancing as between the price per therm and the quality of gas best fitted for the particular appliance. One can understand a certain grade of gas not suiting a certain class of appliance, and an enhanced consumption out of proportion to the purpose being the result. Generally speaking, however, it should not matter whether the gas is bought by volume or by heating value, provided it is of the same thermal value in both cases, and the appliances are fit and proper for the use of the particular grade of gas being supplied.

TAR FOR ROAD PURPOSES.

I would like to add a word on a subject in which I have been interested for many years—*i.e.*, the sale of tar from gas coal as a road-making agent. An extensive and useful market has been developed, and the value of tar has been enhanced thereby, due to its worth for the making of clean and good roads for fast and severe traffic. A point has emerged, however, and the subject is being discussed in the Technical Press, as to the best means of treating the roads so that long life and soundness may be obtained. It is being questioned if, after all, tar from gas coal is just the ideal material; or, alternatively, if the tar is being prepared properly for road making. The point is this. In a variable climate such as ours, the change from summer to winter conditions is very extreme, so much so that in summer time under the hot road conditions the tar melts and overflows or lifts; and everyone knows the plastic nature of many a hot road which has been treated with too much tar. It is most disagreeable to the traveller, and costly to the maker of the road. In very many cases, however, it is a fact that too much tar has been used, and the effect has been overdone. One result is that when the cold winter conditions come along, the road surface breaks up and moisture gets down into the road, due to the top dressing having been broken in the aforesaid manner. Road surveyors are now hinting that gas coal tar is not the best medium for road-making, or at any rate that the treatment which tar at present undergoes does not render it the ideal material for the purpose. It is being stated that bitumen meets the conditions far better than tar, and not only withstands severe winter conditions, but also under summer conditions does not melt, but remains tough. Hence it retains its position on the road, and thus constantly conserves the road surface so that the weather conditions do not penetrate.

I am not prepared to say how far this argument may or may not be true, but I do know, as most of those know who use the roads under summer conditions, how unpleasant it is to see the hot roads covered with liquid tar—in many cases last season's tar re-melted. I do not think, however, it is sufficient to say that gas coal tar is unsuitable; it is just as likely that the tar dressing has been overdone. In any case, it is a subject well worth investigation, if tar is to maintain in the future the valuable position it has secured for road-making purposes. If it is necessary, I do not see that there is any great difficulty in adding a proportion of bitumen, in order to keep tar as the main ingredient to secure clean roads which will wear well. I think this is a subject which we, as gas engineers, should keep in view, and endeavour, even if some additional trouble is involved, to supply our local surveyors with a tar which will serve the purposes of road making as already described.

CONCLUSION.

The foregoing remarks may be criticized as "insular," which term seems to explain the position. Most of the address has been taken up with the work and the affairs of the Gas Department of Kilmarnock; but I do not know that I should offer to the members of the North British Association any excuse or apology. After all is said and done, a man's particular work should be that which is most interesting to him as an individual; and as no two minds work along the same lines, sometimes a description of one's methods may influence a brother working possibly on similar business, but in the manner best suited to his own particular surroundings. It may be admitted that gas supply is the same all the world over, only differing in the magnitude of the individual operations; but the details of manufacture may vary to suit individual conditions. Well, the conditions I have attempted to describe are those which we, as a gas undertaking, had to meet; and I have endeavoured to describe the methods we took to deal with the outstanding features of supply in our community.

In an address such as this, which is bound to be confined within reasonable limits, many interesting subjects cannot even be touched upon which all bear very closely on efficiency—and by efficiency in our own particular industry I mean the maximum sale at the minimum price; and the two things go hand in hand. Every observant gas engineer knows that the competition of the future will be more strenuous than has been the competition of the past; and this is proved by the history of the last eight years.

The industry has been constantly in a transition stage in some way or other, and this is the case to-day more than ever. It would seem that our conditions are now changing in everything which goes to make a gas supply undertaking. Methods of making gas, methods of selling gas, the handling of residuals, and the adaptation of mechanical methods are among the things which are

assuming new and strange aspects; and this is bound to be the case in a struggle for existence, if existence is to be maintained. Fortunately, as I have already stated, I think the gas industry has the vitality to fight for life. It is a long, long time ago since we were told that gas was doomed; but to-day the amount of capital usefully employed in gas manufacture is enormously more than it was twenty years ago, and is equally profitable to the investor, although recent conditions were certainly very oppressive, especially to small works.

WILLIAM MURDOCH.

I do not think I should prolong my observations and try unduly the patience of my hearers. I feel, however, that meeting as we are to-day in the old and historic town of Ayr, intimately bound up with Scottish history, we cannot allow the occasion to pass without some reference to the unique history of the founder of the industry of gas manufacture—William Murdoch.

William Murdoch was born on Aug. 21, 1754, near Old Cumnock, in Ayrshire, just about sixteen or seventeen miles from Ayr. His father was a miller, and a man of a mechanical turn of mind; and this instinct seems to have developed in his son. Near Old Cumnock, William Murdoch made his first observations of the use of coal for gas manufacture; and the study of the science was carried on throughout his lifetime, under changing conditions of employment and situations, until he died in 1839. It is told of him that:

> "His habits were simple, his nature retiring, his character upright and honourable, modest, and unobtrusive to a fault, and the current of his long life comparatively uneventful, and of him in no ordinary degree it may be said that, 'having served his generation, he fell asleep.'"

Is it not, therefore, fitting that we, having met on this occasion almost under the shadow of the place of his birth, should recollect with pride the beginning of that work which has continued after its author has passed away, and is now world wide, and exists wherever the haunts of men are known?

Mr. J. M. SMITH (Stirling) said he should like to convey to the President their hearty thanks for the excellent address he had delivered to them. The standard set by Mr. Fairweather was just what they expected to get from him. From his (the speaker's) coign of vantage on the platform he was able to see that the general body of the members had not been in the least bored by the President's effort. The whole of his observations on the many topics dealt with had been followed with the keenest interest.

Mr. GEORGE KEILLOR (Greenock) seconded the vote of thanks; and the compliment was paid with considerable heartiness.

GAS EFFICIENCIES.

The PRESIDENT reminded the members that at the Spring meeting it had been agreed at the present meeting to resume the discussion on the papers on the general subject of "Gas Efficiencies"* read by Mr. George W. Keillor (Greenock), and Mr. J. Richmond (Penicuik). He hoped the discussion would be brisk and interesting.

Mr. GEORGE BRAIDWOOD (Coatbridge) desired to join with the other members of the Association in congratulating the two authors. Mr. Keillor's paper was strong on the efficiency in use of low-quality gas, and advocated the adoption by municipal engineers of the "charter of liberty" known as the Gas Regulation Act, 1920. In view of the fact that the Gas Investigation Committee had reported that there was little difference in efficiency between low and high quality gas in use, he was of opinion that it was futile attempting to prove that one quality was more efficient in use than another, especially when undertakings were required under section I. sub-section B of paragraph 4 of the Act to alter, adjust, or even replace consumers' appliances in such manner as to secure that the gas could be burned with safety and efficiency. Only by accepting this condition (and no undertaking would be so foolish as to ignore it) might an undertaking take advantage of the liberty allowed under the Act of selling gas of a quality best suited to the requirements of the consumers—the condition of the distribution system and the economic conditions prevailing in any year. A point he thought rather overlooked by Mr. Keillor in his paper was that, given equal efficiency in the use of the different gas qualities, the consumers who were served by sliding-scale companies benefited in the matter of cheaper gas rates, &c. They did so out of all proportion to any financial benefit the shareholders gained by alterations in the declared value. Mr. Keillor did not dogmatize as to the quality of gas most economical to make; and Mr. Richmond believed that, taking count of everything, the higher quality might prove the better. Keeping in mind Mr. Keillor's advice that honesty was the best policy, and his call for proved statements, he (Mr. Braidwood) ventured to give some figures relating to manufacturing and distribution costs, with returns from residuals and cost of coal, for a gas quality of 466 B.Th.U. for the six months at Coatbridge from January to June, 1922. Perhaps Mr. Keillor might supply approximate companion figures for gas of 400 B.Th.U.? In this way it might be possible to arrive at some conclusion as to economy of production. [The details appear at the head of the next column.] The quantities of residuals sold per ton of coal carbonized over the same period were as follows: Coke, 8·76 cwt.; tar, 19·79 gallons; sulphate of ammonia, 47·54 lbs. With regard to the efficient distribution of low-quality gas, he confessed to being unable to see the wisdom of spending capital on larger mains or higher-pressure plant for the doubtful benefit of being able to supply a gas of probably 50 B.Th.U. per cubic foot less in quality. The points raised by Mr. Richmond as to the effect on meters, plant, &c., of the purifying operations used, referred, he thought, chiefly to low-grade gas, high in inerts, rather than to straight gas of low calorific value. However, these points could not be overlooked. So far as he personally was concerned, he was strongly of opinion, after some experience of selling by the therm, that after the Gas Regulation Act had been adopted generally, there would be many more undertakings selling gas of a declared value of 500 B.Th.U. than there would at 400 B.Th.U.

	Total Cost (less Interest and Reserve Fund charges) to Manufacture and Distribute One Therm.	Gross Cost of Coal per Therm.	Return from Residuals per Therm.
January	3·89	3·30	2 88
February	3·54	3·44	4·02
March	4·85	3·47	3·24
April	4·43	3·15	3·62
May	5·49	3·19	3·09
June	5·95	3·31	3·01
Average	4·69	3 31	3·31

Mr. S. MILNE (Aberdeen) said it appeared that at Perth in September, 1921, he gave expression to an opinion which was not commendatory to low-grade gas; and as he failed to bring abundant proof in support of his statement, he brought himself under the lash of Mr. Keillor. He (the speaker) did not think the figures would prove or disprove his opinion. There were other things than figures to be considered in a question of this kind. Public opinion, as expressed through the columns of the Press, could not be ignored. Was it not the case that in certain towns which had come down to low calorific value gas there had been complaints, and that such terms as "very bad," "deplorable," "disgraceful," "pitiful" had been applied to the gas distributed in these towns? In one case they read: "The pale feeble glimmer reveals the mirror to him, but the light fails to bring into prominence the reflection of his blunt but homely features." [Laughter.] Of course, insufficient pressure might be to blame; but whatever the cause, he ventured to say that complaints were more rife now than was the case in the days of higher calorific value. They had experience during the war of reduced calorific value, and received many complaints, particularly from certain large consumers who could not use anything other than flat-flame burners. For example, in connection with the granite industry, where the men worked in open-fronted sheds, it was well known that they had to use flat-flame burners close up to their chipping tools. Then he also found that many engineers still preferred the flexible gas bracket for use at the turning lathes. In such cases, incandescent burners were, of course, out of the question. One might say, why should they not be made to adopt modern methods of enriching with benzole *in situ* if they must have flat flames? This meant an outlay which consumers were unwilling to incur, but it had been done in one or two cases. He might say that the spell of low calorific value gas at Aberdeen, which was compulsory during the war, resulted in a large accession of consumers to the electric lighting department, as soon as service cable and other material were available after the Armistice. He thought it was a mistake to assume that because there were no complaints, everyone was satisfied. He considered dissatisfaction was a state of mind brought about through a craving after something better, knowing that this something was, or ought to be, obtainable. When it was found that this something was not attainable, dissatisfaction ceased, and the mind settled down to contentment with what existed. Was it not possible that a lack of complaints might be due to a spirit of "what's the use? There being only one source of gas supply, it must be put up with." He (Mr. Milne) did not say that was the position at Greenock. He believed it was not. Greenock had been used to low calorific value gas for a good many years now; and knowing Mr. Keillor's reputation for thoroughness, he felt sure he would not rest until his whole district was adjusted to suit the quality of gas he elected to supply. Low-grade gas would not be acceptable in Aberdeen, where the high quality had died hard and a medium quality of 500-520 B Th.U. was now distributed. This quality was giving satisfaction; and personally he was not convinced that they should go much below this so long as they had plant capable of producing it economically. It was borne in upon him more than ever that each engineer would advocate the quality of gas his plant was best suited to produce. If there were small works equipped only with horizontal retorts which were capable of giving nothing else than gas of 560 to 600 B.Th.U., then he thought they would do well to bring the standard down to 500 or 520 B.Th.U. by the introduction of a water-gas plant. He had some experience of these; and he would throw out the hint in passing that, where such a plant was contemplated, it was desirable that a relief holder should be employed, if at all possible, so that while the blue water gas was being made (say, during only six or eight hours in the day), a regular percentage of water gas might be drawn from the relief holder to mix with the rich coal gas uniformly throughout the twenty-four hours. Such an arrangement was (he thought) ideal for small works, and would work-out very economically. Some one had said that, in order to produce gas upon the most economical lines, regard should be had to the market value of residuals, so that when these were at a low ebb, a gas in the region of 400 B.Th.U. might be supplied; while if the value of residuals advanced, a gas in the region of 500 B.Th.U. might to advantage be supplied. In effect, the quality of the gas might slide up or down according to the market value of residuals. This, he rather thought, would be a most unwise policy. What was most to be desired was as nearly as possible a uniform quality of gas throughout the country. When that had been attained, they could reasonably look for standard appliances to consume the gas. Mr. Keillor's statement of comparative efficiencies of cooker burners under average domestic conditions, was very interesting and instructive. The most noticeable feature was the low efficiency of the old-type burner on cookers with straight bars, as compared with the new type, or high-efficiency burner, on cookers with open sectional bars—roughly in the ratio of 40 to 60. It would have been interesting to have had the efficiency of the high-efficiency burner tried with 563 calorific value gas, which, he noted, was only used in

* See "JOURNAL," April 12, pp. 93, 96.

Boiling Burner Efficiencies—Old and New Patterns.

Appliance.	H.E. Boiling Burner (Boiling Ring).															
Number.	1.		2.		3.		4.		5.		6.		7.		8.	
—	Straight Coal Gas from Newbattle Cannel.		Straight Coal Gas from Newbattle Splint.		75 p.ct. Str't. Coal Gas. 25 p.ct. B.W. Gas.		Town's Gas.		50 p.ct. Str't. Coal Gas. 50 p.ct. B.W. Gas.		45 p.ct. Str't. Coal Gas. 45p.ct. B.W. Gas 10 p.ct. Air.		25 p.ct. Str't. Coal Gas. 75 p.ct. B.W. Gas.		41·4 p.ct. Str't. Coal Gas. 41·4 p ct.B.W. Gas. 17·2 p.ct. Air.	
	CO 10·2 p.ct. Inerts *nil.*		CO_2 *nil.* O_2 0·1 p ct. CO 10·2 p.ct. N_2 1·3 p.ct. Inerts 1·4 p.ct.		CO_2 0·2 p.ct. O_2 0·3 p.ct. CO 18·7 p.ct. N_2 3·6 p.ct. Inerts 4·1 p.ct.		CO_2 3·8 p.ct. O_2 0·4 p.ct. CO 13·8 p.ct. N_2 5·9 p.ct. Inerts 10·1 p.ct.		CO_2 0·1 p.ct. O_2 0·1 p.ct. CO 24·2 p.ct. N_2 3 8 p.ct. Inerts 4·0 p.ct.		CO_2 0·1 p.ct. O_2 2·2 p.ct. CO 20·5 p.ct. N_2 12·8 p.ct. Inerts 15·1 p ct.		CO_2 0·1 p.ct. O_2 0·1 p.ct. CO 27·6 p.ct. N_2 4·4 p.ct. Inerts 4·6 p.ct.		CO_2 *nil.* O_2 3·3 p.ct. CO 20·3 p ct. N_2 17 2 p.ct. Inerts 20·5 p.ct.	
Calorific value . .	858·0		644·6		558 0		536·7		475·4		460·4		440·4		395·2	
Pressure (tenths). .	12	21	12	21	12	21	12	21	12	21	12	20	12	20	12	20
Consumption (c.ft.) .	2·070	2·160	2·831	3·019	3·057	3·264	3·399	3·681	3·655	4·067	3·846	4·191	3·957	4·460	4·316	4·390
Time (minutes) . .	15·87	11·93	14·20	11·28	13·90	11·83	13·47	10·82	12·17	10·10	15·40	12·63	12·83	10·90	14·83	13·53
Efficiency (p.ct.). .	59·88	57·39	58·55	55·11	63·99	60·11	59·04	54·37	61 23	55·03	60·09	55·14	61·05	54·17	62·38	61·33

No. 15 Standard Burner (Boiling Ring).

Pressure (tenths). .	5½	21½	5½	21½	5½	21½	5½	21½	5½	21½	21½	5½	21½	21½
Consumption (c.ft.) .	2·470	2·360	3·337	3·342	3 558	3·672	3·750	3·888	4·169	4·179	4·541	4·597	4·562	5·067
Time (minutes) . .	12·98	12·72	15·78	11·53	18 06	10·92	20·08	11·12	21·50	11·23	13·02	23·35	12·35	14·82
Efficiency (p.ct.)	50·20	52 55	49·87	49·79	55·14	53·53	53·38	51·48	53·69	53·56	50·89	52·55	52·96	53·13

Cooker with H.E. Burners (Open Top Bars).

Pressure (tenths). .	22	23	21½	23	21½	23	21/21½	23	21½	23	21½	21½	23	21½
Consumption (c.ft.) .	2·800	2·415	3 426	3·158	3·655	3·437	4·188	3·857	4·686	4·317	4·912	4·977	4·893	5·515
Time (minutes) . .	16·66	20·07	15·50	15·28	14·45	16·20	15·75	16·23	13·73	14·38	14·85	13·45	14·07	15·90
Efficiency (p.ct.). .	44·29	51·35	48·18	52·28	52·17	55·48	47·34	51·40	47·76	51·84	47·05	48·54	49·38	48·82

Old Pattern Cooker—Larger Boiling Burner (Straight Top Bars).

Pressure (tenths). .	20½	20½	23½	20½	20½	20½	20½	20½	20½
Consumption (c.ft.) .	4·250	5·633	4·640	5·359	5·599	5·812	6·343	5·995	7·152
Time (minutes) . .	19·90	23·0	22·95	22·20	24·70	24·82	27·92	26·0	32·60
Efficiency (p.ct.). .	29·18	29·30	35 57	35·58	35·41	38·51	36·44	40·30	37·64

connection with the old-type cookers. He made a number of tests on these lines, and found that with the high-efficiency burner the efficiencies did not vary very much. The table of tests [as reproduced above] was, he was sure the members would agree, interesting and instructive. In conclusion, Mr. Milne remarked that Mr. Keillor's paper had been most interesting and instructive. It had set them thinking and experimenting. The result of these experiments had satisfied some of them that with properly constructed high-efficiency burners, such as were now being supplied by the principal makers of gas appliances—in cooking stoves, range plates, and boiling rings—very nearly the same efficiency could be obtained with 500 B.Th.U. gas as with 420. With the 500 B.Th.U. quality, one had still a gas that would give a fair degree of luminosity even with a flat-flame burner, tens of thousands of which were still being manufactured and distributed throughout the country.

Mr. JAMES JAMIESON (Edinburgh) felt that the subject which had been introduced by his late chief (Mr. Keillor) and Mr. Richmond was one which not only concerned the Association, but was a matter of considerable importance to gas consumers. Gas efficiencies to Mr. Keillor were a hobby; and he was confident his paper would rank for many years as a work of reference. Personally he had the honour of serving under Mr. Keillor, and he had the opportunity of manufacturing and distributing 400 B.Th.U. gas. His position in this respect was probably unique, as to-day he was connected with an undertaking which was notorious for high quality. After an experience of fully twelve months with this high quality, he was more than ever convinced that quality of gas mattered little, provided the composition was constant and the pressure arrangements adequate. It simply boiled-down to a question of £ s. d. He could not agree with his late chief regarding the efficiencies of the various qualities of gas. To his mind, a 500 B.Th.U. gas was, when consumed in ordinary domestic appliances, as efficient as 400 B.Th.U. For lighting, the 500 B.Th.U. gas was, in his view, the more economical. In all the lighting tests which he (Mr. Jamieson) had recently seen carried out, the "universal" mantle was used. He had no doubt that if the medium mantle had been tried—the type of mantle which was largely used in Greenock—the low-grade gas would have given a much better account of itself. Personally, he could not see why a gas diluted with CO and H_2 should not give excellent results in an incandescent mantle, providing the mantle fitted the flame. Mr. Keillor mentioned that flame volume was important, but he (the speaker) rather thought flame temperature was what was meant. Indeed it seemed to him that it was on this one point that the virtue of low-grade gas existed. Certainly unless sufficient gas was burned to fill the mantle, flame temperature was useless; but without the air-gas ratio being low disappointing results were sure to follow. It had been well enough discussed that each undertaking must decide for itself which quality of gas was most efficient, taking into consideration the manufacturing and distribution plant available. If, after his experience with the two qualities of gas, he were asked which gas would be more economical for Edinburgh, he would without hesitation say 500 B.Th.U. This was not on account of any weakness in 400 B.Th.U., but was simply based on economic reasons. If, on the other hand, he were asked to make a declaration for Greenock, he would say 410 B.Th.U. Their manufacturing plant at Granton consisted of inclined retorts, which gave a straight coal gas of 550 B.Th.U.; and this was diluted down to 500 by the introduction of water gas. This brought him to a very important point. Mr. Keillor had very ably summed it up by saying that the hunt for therms was going to be a much more exacting and scientific business than the mere plebeian task of collecting cubic feet. With their present process, results as high as 80 therms in a concentrated form could be produced, and the question which was occupying their attention at the present time in Edinburgh was: "Can a one-stage process, carbonizing ordinary Scotch coal, produce gas of 500 B.Th.U. quality constant enough to comply with the Gas Regulation Act; and if gas of this quality can be produced in verticals, is it an economic process in comparison with the two-stage?" Frankly, he had to be convinced yet that such was the case; and this after a long experience with vertical retorts. Unlike Mr. Richmond, he had yet to learn the simple process of making 500 gas, and a more difficult declaration could not be selected. Inclined and horizontals produce too rich a gas. He thought machine-charged horizontals with water gas was the most economical process in the production of therms; and results quite up to 120 therms of 400 B.Th.U. gas would be attainable per ton of coal carbonized. The next point which made for his recommendation for 500 was that storage accommodation was limited; and as gasholders were not remunerative, any additional storage capacity increased the capital costs, which directly affected the therm cost. All their gas in Edinburgh had to be pumped from the works to the distribution stations; and if they could pump a therm by handling 200 c.ft. instead of 250, the cost was less for the higher quality. Mr. Keillor's boiling tests were very interesting. As Mr. Gracie had said, they made tests of various qualities of gas from 500 B.Th.U. down to 300; and the interesting point which was to be noted was that one B.Th.U. was as good as another from 500 B.Th.U. down to 400. It was apparent, therefore, that there was no advantage to the consumer unless it could be produced cheaper. This test was confirmed by taking a few cookers from the district and, without alteration, testing at 500 B.Th.U. quality, and then adjusting to give the best results with the lower quality of gas. A very important point was noted, however, in running these tests—viz., that the design of the kettle was of considerable importance; and any person comparing results with Mr. Keillor's would do well to watch this point. A so-called heat-saving kettle was found to be actually much less efficient than an ordinary kettle. In stating boiling-test efficiencies, it would be well to give the design of the kettle used. There was, however, an important factor, and this was the time taken to do a stated amount of work; and there could be no question that high-grade gas was the better by far. To produce equal time results, a very serious loss in efficiency was recorded for low-grade gas. Speaking about efficiencies, they must remember they were not doing justice to the consumers with the old solid bar hotplate; and he thought it was scandalous to encourage such apparent waste and still talk of gas manufacture as an economic process. Efficiencies as high as 65 p.ct. could be obtained with modern boiling burners, as against 40 p.ct. with the old type. Had they anything to lose by converting to the higher efficiency type? It would make no difference in fuel costs to the consumer, although the gas was increased in price a little, as the saving in consumption was most marked. This was a point which was important in a district where the capacity of the mains was limited, as much

less gas had to be driven. Regarding Mr. Richmond's paper, he would only treat with two paragraphs. He was confident, as far as destruction of plant was concerned, if Mr. Richmond was producing in horizontals 500 B.Th.U. gas, then he might look for such destruction sooner in Penicuik than in Greenock. [Laughter.] The corrosion deposit in service-pipes had been an alarming business during recent years, and he was sure this wasting was less apparent in Greenock than in any other large town. Mr. Richmond invited them to compare the interior to-day of a holder which had for a number of years stored lower-grade gas with that of a gasholder where high-grade gas had always been stored. During his (the speaker's) time in Greenock it was his privilege to get into one of the holders to examine it. The holder was about 48 years' old, and no evidence of corrosion was apparent. This holder had stored some very low-grade gas, but without any serious damage—in fact, the skin was as good as the day it was built. Mr. Richmond would probably say that the protective quality of high-grade gas was responsible. Surely if this was the case low-grade gas could not then be responsible for the drying of meter diaphragms? This was a most important subject; and after supplying low-grade gas in Greenock for a number of years, he was prepared to say that the repairs in meters were less per therm than in most undertakings in Great Britain to-day. Mr. Keillor, he felt sure, could give some very important information on this subject. Low-grade gas, if manufactured properly, was not more detrimental to distribution plant than high-grade gas, and it was certainly much less destructive than a 500 B.Th.U. coal gas from horizontal retorts.

Mr. JOHN WILSON (Motherwell) said that the ideas with regard to high-grade and low-grade gas had changed somewhat. As a matter of fact, what they called high-grade gas to-day would have been considered low-grade gas not so long ago. When all was said and done, gas which to-day was spoken of as high-grade was not so very high. It seemed to him, however, that there was still one question which he did not think had been satisfactorily gone into—viz., What is the best gas in the interest of the consumer? It seemed to him that they were dealing far too much with what it cost to make per therm and what it cost to sell. They seemed to forget the important point as to what it cost to buy gas. He had been making one or two experiments in this direction; but these were not sufficiently advanced as yet to enable him to say much about them. As gas managers, he felt they ought for a little to turn their minds and thoughts in that direction. The tables and results that had been obtained so far were more or less what might be called laboratory results. No doubt it was true to say that with the modern high-efficiency burner the efficiency of various types of gases did not vary very much. That was true; but what was the position when they put the burner into the hands of the ordinary consumer? He took it as he got it, stuck it up, and he was really lucky if he got any efficiency at all. This, at all events, had been his experience in going round the district. They had been told of the appliances that were coming in for lower-grade gas. On this point he would like to mention that in his experience fewer complaints came from the newer types of houses, and practically no complaints at all (he might say) from the various housing schemes that had been completed during the past few years. This seemed to show that low-grade gas could perform its work to the satisfaction of the consumer. Touching on the question of wastage, he would like to mention that recently he opened-up a station meter which was registering somewhat slowly. He fully expected to find it holed; but to his surprise the meter was perfect; and this after running for 23 years. The trouble appeared to be entirely due to the giving-out of the chains on the manhole doors. To-day this meter was practically as good as when it was first installed. In his district, they recently raised the quality to about 400 B.Th.U. [Laughter]—and it was a remarkable fact that they were having more complaints now than they had previously. This went to prove that it was a question of adjustment and the continuance of a constant supply. If they varied up or down, they were certainly letting themselves in for trouble. There was yet another point that he would like to bring out. He noticed from the Press that those undertakings which had gone in for the Gas Regulation Act, and had declared 400 or so B.Th.U., had changed their policy. They appeared now to be going in for 475 or 500 B.Th.U. He was not quite sure of the reason for this. Those in charge of these particular undertakings said that the gas was cheaper to make. His own feeling was that the change-over had been agreed to because it was getting them more money and was paying them better. No doubt it paid them better; but did it pay the consumer? He wondered if they could find out from any of those undertakings which had raised their calorific value how their receipts compared with previous days. If the receipts had gone up considerably, then it looked to him as if the consumer again was paying the piper.

Mr. DAVID FULTON (Helensburgh) remarked that in the early part of his paper Mr. Keillor took the managers of municipal gas undertakings severely to task because they had looked somewhat frigidly at that part of the Gas Regulation Act which allowed suppliers to charge by the therm; and the company people were apt to take up a somewhat lofty attitude in the matter, and imagine that they were the only people who considered the interests of the consumer. On the latter point he thought there had been a great deal of embellishment. It might conceivably be to the advantage of the consumers who were served by the company that they should be charged on the basis of the heat unit supplied; but at the same time it must not be forgotten that the Gas Regulation Act gave them the opportunity of adjusting their prices. This, he thought, was the primary consideration. Consequently, he considered it a little bit of fudge—all this talk about the consumer first and the company afterwards. He conceded, however, that municipalities were in an altogether different position. No municipality would earn profits, and therefore the selling price of gas in a municipality was actually the cost price of the gas. Accordingly, this being the position, it did not matter a jot whether the gas consumer was charged per cubic foot or per therm. Why, he might ask them, should any municipality go to all this trouble and additional bookkeeping simply to charge by therms? It imparted confusion to the mind of the consumer, and it would be an intricate calculation for the latter to transform cubic feet into therms. It seemed to him that the municipalities should adopt the suggestion which was given out in a letter appearing in the Technical Press, and mark on the account forms a statement to the effect that the gas was guaranteed to be of a certain quality. If this were done, the whole purpose so far as the municipalities were concerned would be adequately filled. As regards the quality of the gas to be supplied, there had been no more pointed remark in the course of the discussion than this—that plant was very often the deciding factor. It was rather strange to him, looking back on his very short experience, to see how low-quality gas had been born so to speak from newer methods of carbonization and new forms of plant which did not so efficiently produce the higher quality of gas. He did not think anyone could deny that with vertical retorts gas running about 400 or 420 B.Th.U. was most efficient and most economical to produce. He sometimes wondered, however, if the advocates of vertical retorts would be so enthusiastic as to claim that they could produce 500 B.Th.U. economically. This, as he had already remarked, resolved itself into a question of plant and very little else. In Helensburgh they had a residential district, and it differed in that respect from Greenock, where the population was to a large extent industrial. In his town the consumption was mainly domestic; and lighting was a very important part of it. He supposed lighting would be rather more than half of the consumption, in spite of the fact that they had in almost every house a gas-heater and in many houses a considerable number of gas-fires. Still, lighting was, and would be, their chief outlet. It seemed to him, however, with all due respect to Mr. Keillor, that a gas of from 410 to 420 B.Th.U. was a more finicky article and more sensitive. On this account incandescent burners were apt to give less satisfaction. In Helensburgh, the gas they supplied was round about 460; and frankly he would not mind if there was a little more fat about it. He considered fat was a good thing, and to his mind gas was all the better for a little in the way of hydrocarbons. It could not be denied that since they started supplying lower quality gas in Helensburgh, they had spent a great deal of extra money in the district. They required to spend money in educating the consumers as to burners; and the fact of the matter was that they needed always to be out in the district in regard to something or other.

Mr. LAURENCE HISLOP (Uddingston) said he was glad that the Council of the Association had given them an opportunity of further discussing the valuable papers submitted by Messrs. Keillor and Richmond at the Spring meeting. He would remind the members that economical production of therms did not necessarily require a large make of gas per ton, as the local value of residual products required to be taken into account in deciding as to the most economical calorific value to manufacture. When the system of charging for gas by the therm became universal, then some of their experts who were so fond of writing to the Press for their own self-glorification might find it pay them better to give more attention to their own undertakings and less to those of their neighbours. It seemed to him that local circumstances, such as excessive taxation and heavy capital, were often overlooked by those busybodies who might be fortunately situated in this direction. Mr. Keillor had aired his grievance regarding what he termed "a sensational announcement" made at the Spring meeting in 1919; but he could assure him that 30,000 c.ft. per ton on the dry basis was made and delivered to the consumers for several months about that time. The calorific value was determined experimentally, and checked by analysis, being an average of 385 B.Th.U. He was then so short of coal that the make per ton had to be stretched to the utmost to keep them going. They ought to consider the "sensational" claims made by various makers of total gasification plants—and some of these, by the way, he considered to be quite genuine. Mr. Keillor had dreams of a two-stage process to give 40,000 c.ft. per ton of 420 B.Th.U. gas. In this connection, it was interesting to note that a similar idea of the late Mr. Wm. Young was published in the "GAS JOURNAL" after his death (in 1906); but it had not been introduced on a practical scale as yet. Personally, he felt that every encouragement should be given to the younger members of the Association to come forward with any practical ideas with which they might have experimented. The pioneer work of Mr. James Blundell and others on steaming in vertical retorts, and the improvement of residual products, had resulted in the gas industry being once more very much alive. He did not agree with Mr. Keillor's remark that slow travel and high steaming had any detrimental effect on the life of the material in the setting. An experience of eight years at Uddingston proved the opposite. The great advantage of being able to manufacture any quality of gas which might be found to be most economical would to his mind always be the feature of continuous vertical retorts. The keeping-up of a steady uniform quality of whatever calorific value was decided upon was of the utmost importance to the consumer. Mr. Long, of Alexandria (who had found it impossible to get along to the present meeting), had asked him (the speaker) to submit for the information of the members the results of the following tests. In all the tests the output per retort was more than anticipated:

	A	B	C	D (two coals mixture)
Gas per ton, c.ft. . .	22,540	22,300	21,350	21,020
Cal. val. B.Th.U.. .	420	415	426	425
Therms per ton . .	94·66	92·54	90·9	89·3

Mr. Keillor had expressed doubt as to the ability of anyone to get more than 80 therms per ton. He (Mr. Hislop) happened to have with him a few of the tests on high steaming with moderate temperatures which were carried out at Uddingston by Dr. Colman towards the end of 1921. The results were given on the wet basis. Before submitting the tabular statement, he desired to explain that the moisture in the local coal was excessive, owing to the short distance from the colliery washer to the works. It was also well to bear in mind that they used only nuts, owing to the fact that they had no coal-breaker. The steam for the retorts was supplied from a waste-heat boiler installed in the chimney; but the steam was not superheated before entering the retorts. [The details appear on p. 587.]

Mr. GEORGE KEILLOR (Greenock), in replying to the points raised in the discussion, said he had been very pleased indeed to hear the interesting debate that had taken place. It was altogether a capital suggestion that had been made by the President at the Spring meeting that the two papers should be further discussed on this occasion. So far as the discussion had gone, he felt very much in agreement with

TESTS MADE ON SETTING OF EIGHT GLOVER-WEST CONTINUOUS VERTICAL RETORTS AT UDDINGSTON GAS-WORKS.

By HAROLD G. COLMAN, D.Sc., Ph.D., F.I.C.

November and December, 1921.

Setting Furnished with Waste-Heat Boiler to Supply Steam Required for Retorts.

—	Bothwell Nuts.	Mitchell Main Nuts.	Mitchell Main Nuts.
Duration of test	121·7 hrs.	72·08 hrs.	86·07 hrs.
Aver. temp. combust. cham.	*1170° C.	*1160° C.	*1210° C.
,, ,, circulating ,,	*1100° C.	*1100° C.	*1115° C.
CO_2 in waste gases	18 p.ct.	18·5 p.ct.	18·5 p.ct.
O ,, ,, ,,	2 ,,	1·1 ,,	0·8 ,,
COAL—			
Total coal carbonized	123·5 tons	61·7 tons	58·1 tons
Moisture in coal (as charged)	*12·5 p.ct.	*3·1 p.ct.	*3·3 p.ct.
Volatile matter in coal	32·4 ,,	29·6 ,,	28·8 ,,
Ash in coal	4·4 ,,	5·6 ,,	6·7 ,,
Coal per 24 hours (per retort)	*24·28 tons *3 ,,	*20·56 tons *2½ ,,	*16·20 tons *2 ,,
STEAM—			
P.ct. of coal	29·5 p.ct.	28·0 p.ct.	36·1 p.ct.
GAS—			
Total gas (corrected)	2,998,690 c.ft.	1,283,487 c.ft.	1,415,900 c.ft.
Gas per ton	*24,300 ,,	*20,320 ,,	*24,370 ,,
Calorific power, gas	*398 B.Th.U.	*465 B.Th.U.	*430 B.Th.U.
Therms per ton	*96·7 therms	*94·5 therms	*104·8 therms
,, per retort per day	*293 ,,	*243 ,,	*212 ,,
N and CO_2 in gas	*13·2 p.ct.	*11·2 p.ct.	*12·1 p.ct.
COKE—			
Total dry coke made	55·6 tons	39·49 tons	34·72 tons
Per ton of coal	*9·08 cwt.	*12·8 cwt.	*12 cwt.
Ash in dry coke	8·5 p.ct.	9·0 p.ct.	12·8 p.ct.
TAR—			
Total tar (dry)	2320 galls.	1322 galls.	1014 galls.
Dry tar per ton of coal	*18·79 ,,	*16 ,,	*17·45 ,,
Specific gravity of dry tar	1088	1089	1092
AMMONIA—			
Galls. 10 oz. liquor per ton	50·41 ,,	26·7 ,,	36·7 ,,
Sulph. am. (pure) per ton	*44·17 lbs.	*22·5 lbs.	*30·9 lbs.
AIR FOR PURIFICATION—			
Air per cent.	1·6 p.ct.	2·6 p.ct.	0·9 p.ct.
FUEL CONSUMED—			
Fuel for heating retorts, Dry ash-free coke	14·8 lbs.	16·8 lbs.	20·9 lbs.
Dry coke with 10 p.ct. ash (per 100 lbs. coal)	*16·4 ,,	*18·7 ,,	*23·2 ,,
RESULT OF THERMAL BAL.—			
Thermal efficiencies—			
(1) Gas production	65·4 p.ct.	65·4 p.ct.	57·6 p.ct.
(2) Carbonization	80·8 ,,	81·7 ,,	75·5 ,,
WASTE-HEAT BOILER—			
Temp. of waste gases—			
Inlet—below boiler	*840° C.	*850° C.	*890° C.
Outlet—above boiler	*475° C.	*480° C.	*495° C.

* All results are given on wet basis.

all that had been said. He would remind them, as the Secretary (Mr. Fulton) had said, that when he set out to write this paper he had an object in view. Indeed, he might go so far as to say that he had one or two objects in view. In Greenock, their experience had gone to show that gas of 410 B.Th.U. was a splendid article; and nothing better was needed. On this point he had gone so far as to state publicly that people who were selling anything higher were not acting with justice to the consumers. It seemed to him that the figures which Mr. Milne had produced that day proved the contention up to the hilt. The question of distribution had been mentioned. Somehow or other it was always introduced when low-grade gas was referred to. They were told that where low-grade gas was supplied they were immediately faced with the question of increasing the mains and services, and so on. The reply to this was quite an obvious one. His friend Mr. Smith, of Stirling, in discussing the paper at Kilmarnock, rather misunderstood him in thinking he was referring to efficiency in production. It was not efficiency in production at all he was claiming for in respect of low-grade gas, but efficiency in use. He was pleased to know that Mr. Braidwood had got such magnificent results; and he congratulated him very heartily. Mr. Braidwood, he feared, had also rather misunderstood him. He (Mr. Keillor) did not offer to the members any apology for not introducing in his paper the burner efficiency results which he got from high-quality gas. He did not set out to prove this point, to prove that low-grade was more efficient than high-quality gas. It would doubtless, however, interest the suppliers of high-quality gas to know that the efficiency in use with gas of about 563 B.Th.U. in a modern burner was slightly higher than the efficiency in use with 410 B.Th.U. gas. On the paper that had been read, Mr. Milne had some very interesting things to say. He conceded the point that a gas engineer was keen to supply to the people in his town the gas which he thought they liked; but this being so, he was further of the opinion that it was up to the gas engineer to show the people that they could use something less to better advantage. It might take a little time to do it; but he believed the period was fast approaching when it would have to be done. Mr. Jamieson had some very complimentary things to say of himself and the paper, for which he was grateful. Apparently in Edinburgh they were getting remarkably good results from that quality of gas. In passing, he should like to ask Mr. Jamieson if they could have the composition of that gas, because from the tests they had made in Greenock they could not get from 500 B.Th.U. gas the same efficiency as from 400 B.Th.U. It seemed that in Edinburgh they obtained a higher efficiency in use from 500 B.Th.U. gas than they could get from 400 B.Th.U. Something had been said about the corrosion of meters; and on this point he should like to say that they had been supplying low-grade gas for a long period in Greenock, and they had experienced there no such thing as corrosion and meter deterioration. He had a word or two to say about that at the last annual meeting of the Waverley Association in Galashiels. He said then what he was prepared to repeat now—that their account in Greenock for the repair of meters, &c., had not gone up. He was pleased to find Mr. Wilson, of Motherwell, supporting his contentions in regard to low-grade gas. The remarks he had made were very sensible. In the discussion Mr. Fulton had something to say in regard to the introduction of the Gas Regulation Act. Well, in Greenock, they had adopted it because he thought it was his duty to do so in the interests of the consumers. This was now an Act of Parliament; and he felt they would all have to adopt it sooner or later. His view on the general question was that the consumer was going to get honest value for his money in paying for gas by the therm.

Mr. J. RICHMOND (Penicuik), in the course of his reply, remarked that in discussing the subject of thermal efficiencies it was only right that they should pay a tribute to the excellent paper read in April last by Mr. Keillor. To his mind, it was one that would rank among the many notable contributions to the Association. The author dealt with his subject as only a man in his position possessing all the necessary appliances and opportunities for research could do. He had presented his data in a fair and unbiassed manner; and the subject was still left open for discussion and controversy as to whether high or low grade gas was the best to make and supply in the interests of the seller and the consumer. So far as the consumer of gas was concerned, there was nothing at variance between what he (Mr. Richmond) had asserted and Mr. Keillor had advocated. Mr. Keillor said: "It is a truism that the consumer is just as well off with gas in a highly-concentrated form as he is with a gas in a less concentrated form so long as he obtains it on a comparative price basis." The question then came to this—Did the consumer obtain it on that basis? If they conceded this, then there was practically nothing to argue about from the point of view of the consumer. It would be noticed that Mr. Keillor qualified his admission by adding this proviso—"so long as he can utilize either gas equally efficiently." Then followed a series of carefully-compiled tables of experiments, which proved to the writer's own satisfaction that greater efficiency was obtained with gas of the lower calorific value. It was, however, to be noted that the greater efficiency was obtained with the more modern appliances; and he ventured to state that if half the research and experimental work had been put into appliances for the consumption of high calorific value gas that had been expended on appliances for the consumption of the lower quality now generally in use, the consumer would stand to gain by the higher quality of gas. Conceding, as Mr. Keillor did, that the consumers' interest lay in the relativity of price, then the question was boiled down to one of economic production. He would leave members who were in a better position than he was to deal with that question; but since the April meeting nothing had occurred which tended to show that gas of a lower calorific value was more economical to produce. On the contrary, they saw, in point of fact, that some of the foremost gas undertakings in the kingdom were raising their calorific value. Taking into account the wear and tear of plant, meters, and mechanism, as well as the purification and distribution costs, these undertakings seemed to think it was more economical to produce a moderately high-grade straight gas. Altogether he saw nothing to alter the opinion he had already expressed, that the higher quality of gas was the best to make and supply in the interest of the seller as well as the consumer. They must admit that the advent of low-grade gas synchronized with the downward tendencies of other commodities during the war. The circumstances which prompted these downward tendencies no longer remained; and it was for them, as honourable traders, to revert to giving a good article at a reasonable price. The first three pages of Mr. Keillor's paper were devoted to a defence and a eulogy of the Gas Regulation Act. This being so, it seemed to him quite appropriate that the Act and the thermal system of charging should be discussed in conjunction with the paper. They in Scotland had already had an Act foisted upon them which 90 p.ct. of the people did not want—he referred to the Education Act—and he hoped it would not be said that the Gas Regulation Act was to be forced upon them without a free and unfettered ventilation of opinion. The Act might be made compulsory by a simple stroke of the pen; and since that was the position, he hoped the members of the Association would not hesitate to let their opinions be known, even though there was a risk of hostile criticism of the gas industry by or through the public newspapers. In a recent issue of one of the technical journals, the question was put in a leading article—Is the therm popular? A number of replies were received to the query; and he noticed that one contributor aptly summed up the present position of the gas industry as having arrived at the stage known as "the morning after the night before"—a stage when they could meditate on cause and effect. Personally, he was going to assert that the Gas Regulation Act was unpopular and the therm less popular. The apathy with which gas undertakings adopted the Act bore this out. He felt it was true to say that those who had adopted the Act had invariably had ulterior motives. Mr. Keillor referred to the Act as "a Charter of Liberty." The liberty lay in the direction of reducing the quality of gas and indirectly increasing the price. Indeed, he ventured to say that if power had been given the statutory gas undertakings to increase the price of gas on the 1000 c.ft. basis, they would never have heard anything at all about charging by therm. Even the President of the Institution of Gas Engineers seemed to doubt if the therm was popular, because it would have been observed that the following appeared in a recent address by him: "It has been said, 'learn to think in therms;' and every effort has been made to do so. Makes of gas have been stated in therms per ton of coal carbonized; wages have been calculated to pence per therm; capital has been converted to pounds per therm; but I do not think the figures convey their meaning quite so clearly to the mind as do those based on 1000 c.ft. of gas or per ton of coals." In conclusion, he (Mr. Richmond) desired to add one word—namely, that it would be a blessing if the members were that day to voice their opinion on the Gas Regulation Act.

VOTES OF THANKS.

On the call of the President, votes of thanks were passed to the authors of the papers discussed on the subject of gas efficiencies.

THE VALUATION OF OXIDES FOR GAS PURIFICATION.

Discussion.

Discussion was afterwards invited on the paper contributed by Mr. G. H. Gemmell, F.I.C., the Official Analyst to the Association, on the subject of "The Valuation of Oxides for Gas Purification."

Mr. G. H. GEMMELL said that Mr. Fulton, the Secretary of the Association, kindly arranged for the publication of the paper in the "GAS JOURNAL" for Aug. 30 (pp. 471-3), in order that members might have an opportunity of reading it prior to the meeting. It had accordingly been arranged that the paper should be held as read. The reasons for taking this course were as follows: (1) The greater part of the paper consisted of analytical data, giving the results of his experiments with various oxides, and it would be a dreary business to sit and listen to a recital of these figures. (2) By prior publication, those interested were in a better position to discuss and criticize the paper, and there would also be more time to do so. The first point to which he would draw attention was that it was possible to ascertain by a laboratory test the fouling value of an oxide, and that results were obtained equal to those which were obtained in good practice. It was well known that the same oxide did not always give the same results in different works, due to variation in the quality of the gas, or the conditions under which the oxide was used. A laboratory test should, therefore, be a useful guide to a gas engineer. If he did not obtain the same results in the works as the laboratory test showed, an inquiry as to the cause was clearly indicated. From time to time, results were published of fouling tests; but as a rule no description was given of the method, the quantities of material used, volume of gas, time, temperature, &c. Since preparing this paper, he had already obtained good results in less time; but the modified method had not been tried with a sufficient variety of oxides to permit him to publish them. He suggested that these results might form the basis of a standardized method of testing oxide. That some standard method was required was apparent from the experimental work carried out by H.M. Inspector of Alkali Works, and described in his annual reports. He favoured volumetric methods for determining the efficiency of an oxide, and measured the volume of H_2S an oxide was capable of absorbing. His (Mr. Gemmell's) results showed that the sale of oxide with 50 to 55 p.ct. of water was not to the advantage of the user, as this percentage was not essential for fouling activity. The tables showed that, after a short period of fouling, the water contents of the oxide fell below 10 p.ct.—sometimes as low as 4 p.ct. For every ton of oxide containing 45 p.ct. of water, carriage had to be paid for one-third ton of water, which, if it was essential, though it was not, could quite readily be added at the works. It was objected that if too dry, it was dusty, and was blown about in loading and transit. With 10 p.ct. water, it was sufficiently moist to prevent this; and he suggested that oxide should be purchased on the basis of 10 p.ct. water. The Research Committee of the American Gas Association had not yet been able to decide on the best figure for water content; but when it was known that the oxide was efficient with 4 p.ct. of water (Lewis T. Wright said it reached its maximum efficiency at 4 p.ct.), it appeared to him an absurdity to purchase it with 50 p.ct. The most important conclusion from these tests was that one ton of an average oxide, containing originally from 6 to 10 cwt. of water, should yield at least 30 to 32 tons of fouled oxide with only 4 to 5 p.ct. of water, and from 50 to 60 p.ct. of sulphur, or, put in another form, for every ton of original oxide used, he should be able to sell 15 to 20 cwt. of sulphur.

Mr. J. W. M'LUSKY (Glasgow) said that Mr. Gemmell had given results which must have involved a good deal of labour. He had provided a useful reference; and he hoped that the contribution would provoke and promote a profitable discussion. He wondered why the author called the subject-matter of his paper "a valuation." Should it not rather read: "The Behaviour of Oxides" or "The Character of Oxides." He believed Mr. Gemmell was sincere in his desire to help them; but there was no reference to costs of material or wages, and the fact remained that the final test of purifying efficiency was the cost per 1000 c.ft. manufactured—consistent, of course, with clean gas and comfortable working. He referred to comfortable working, because there were materials offered for purification purposes which, although sometimes appearing to be attractive so far as initial cost was concerned, involved future trouble and expense caused by sudden local heating and inability to take up H_2S after 24 to 30 p.ct. was absorbed In Glasgow, they were almost continually testing samples submitted for analysis and report. These varied widely in percentages of ferric oxide, Si, MgO, Al, and CaO. He had visited works where, owing possibly to a combination of circumstances, artificial material consisting of burnt spent oxide and a mixture of soda ash, sawdust, and stable sweepings had been successfully used. Quite the reverse, however, had been their experience in Glasgow. He had seen material of this description mop up H_2S with amazing rapidity at 100° Fahr., owing doubtless to the successful distribution of ferric hydrate through the finely-powdered mass; but after 24 p.ct. S, the material was played out and taking up useful space in the boxes. It was interesting to note that in his book Mr. Meade recommended that moisture should not exceed 50 p.ct., and Fe_2O_3 not less than 25 p.ct. The pre-war Glasgow specification was: Moisture not over 45 p.ct., and Fe_2O_3 not less than 31 p.ct. To-day they were using Dutch bog ore where the moisture was not over 30 p.ct., and Fe_2O_3 not less than 40 p.ct. He was convinced that this quality was ultimately the most economical and efficient medium for their purposes. There was, of course, excellent material in Donegal; but the labour problem there at the moment baffled solution. It might interest the members to know that last year the purification costs in Glasgow were 0·84d., as compared with 0·71d. for 1921. These figures covered the cost of bog ore, sundry materials, and wages less receipts for spent oxide.

Mr. DAVID VASS (Perth) said there was material here which members did digest and study at leisure. The author had directed their attention to lines that would be very effective to all the members in enabling them to determine in a few weeks what they could really expect from oxides. Personally, he was much indebted to Mr. Gemmell for directing his attention to the line of action that was proposed.

Mr. BELL (Dumbarton) suggested that the discussion on this paper should be held over until the Spring meeting.

Mr. GEMMELL said he regretted he did not catch all that had been said by Mr. M'Lusky; but if the observations were reported, he might be able to reply to them later if it was thought necessary.

The matter of holding over the paper for further discussion at the Spring meeting was referred to the Council.

ELECTION OF OFFICE BEARERS.

It was reported that the election of office bearers had resulted as follows:

President: Mr. John M. Smith, Stirling.
Senior Vice-President: Mr. John W. M'Lusky, Glasgow.
Junior Vice-President: Mr. James Campbell, Dunfermline.
Members of Council (two vacancies): Mr. Harry H. Gracie, Edinburgh. Messrs. J. Bell (Dumbarton), J. D. Keillor (Hawick), and Anthony Nisbet (Paisley) had tied for the second vacancy. As they had each the same number of votes, it was announced that a further ballot would be necessary.
Auditors: Messrs. David Spalding and Muir, C.A.

NEXT ANNUAL MEETING.

The PRESIDENT-ELECT (Mr. J. M. Smith, of Stirling) thanked the members for the honour they had conferred upon him in electing him as President. He was prepared to suggest, if it was acceptable to the members, that the Spring meeting should be held in Edinburgh, and that the next annual meeting should take place in the ancient town and burgh of Stirling.

THE ASSOCIATION'S GOLD MEDAL.

Before the proceedings terminated,

Mr. JAMES DICKSON (Johnstone) presented the retiring President with the gold medal of the Association. The meeting had been a highly successful one—thanks to the skilful manner in which Mr. Fairweather had piloted the business through. It was an interesting fact that the Council's report had been carried without a single dissentient voice.

SOCIAL FUNCTIONS.

In connection with the annual meeting, a number of enjoyable social functions were carried through.

THE ANNUAL DINNER.

The annual dinner was held on Thursday evening in the Town Hall, Ayr, and was presided over by Mr. CHARLES FAIRWEATHER. An interesting toast list was gone through. Mr. J. W. M'LUSKY (Glasgow) proposed "Kindred Associations," and fitting acknowledgment was made by Alderman JOHN CLARK (Chesterfield), the Chairman of the Society of British Gas Industries. Ex-Provost MATTHEW SMITH (Kilmarnock), in a witty speech, gave "The North British Association of Gas Managers," and Mr. FAIRWEATHER suitably replied.

BOWLING AND GOLF COMPETITIONS.

On Wednesday, on the Ayr bowling green, an interesting three-rink game was played. The winning rink comprised Messrs. J. A. Tait (Bridge of Allan), L. Hislop (Dundee), and R. Allan (Glasgow). Over the Barassie course, a golf competition was played on Wednesday afternoon. In this event, the best scores were returned by Messrs. Alexander Mackenzie (Dunblane); R. B. Waddell (Polmont); J. O. Scott (Edinburgh); E. Edison Stones (Glasgow); G. A. Mitchell (Glasgow); H. Rule (Kelty); E. W. White (Monifeith); and E. J. King (Elland).

The general secretarial arrangements for the meeting were carried out with characteristic efficiency by Mr. David Fulton (Helensburgh).

Flame Temperature of Gases.

Dealing with the subject of the industrial uses of gas, Mr. Harry Dobrin, of Birmingham (Ala.), said in a recent paper that often manufacturers would dismiss the suggestion that they should use gas with the brief statement that it had too low a flame temperature. As to this, he proceeded, the theoretical flame temperatures of available gases are as follows:

Gases.	B.Th.U. per C.Ft.	Parts of Air Required for Perfect Combustion.	Theoretical Flame Temperature Deg. Fahr.
Natural gas	1018	10·64	3226
Carburetted water gas	533	4·89	3422
Coke-oven gas	480	4·35	3375
Blue water gas	360	3·25	3350
Producer gas	130	1·10	2663
Blast-furnace gas	95	0·75	2345

Now the lowest flame temperature of any of these gases, if attained, will suffice for almost any operation—excepting, perhaps, those which require the high temperatures attainable in the electric furnace. Even blue water gas, says Mr. Dobrin, with only 360 B.Th.U. to the cubic foot, has a higher flame temperature than natural gas with over 1000 B.Th.U. per c.ft. Thus the misconception of the low flame temperature of a gas "is principally due to a lack of understanding of the fundamentals underlying the combustion of a gas."

GAS AND FOOD PREPARATION.

What is claimed by the organizers of the exhibition to be the greatest display of food supplies and of their preparation that the world has ever seen, is at present staged at Olympia, where the Nations' Food Exhibition was last Wednesday opened by Sir Thomas J. Lipton, Bart., and is to run until Sept. 26. It is a show calculated to "make one's mouth water;" and it may therefore be safely concluded that it will make a successful appeal to the popular taste. This being so, it is satisfactory to note that the numerous visitors will have their attention drawn to the advantages attaching to the use of gas in the preparation of food of every kind and under all conditions. Labour-saving devices are, in fact, a feature of the exhibition—and this feature would be sadly incomplete without the inclusion of the gas-cooker, which is probably the greatest labour saver of all to the busy housewife.

What can be done with the gas-cooker is to be learned in the gallery at the stand of the Brentford Gas Company, where demonstrations are given, and a display is made of modern gas-heated labour-saving apparatus. There is to be seen the "Brentford" standard cooker, a full description of which appeared in the "JOURNAL" for Nov. 9 last [p. 432]. The principal features of this cooker are control of the oven ventilation and an adjustable hotplate. Control is secured by regulating the admission of air to the oven through openings on each side of the lower part. With the exception of these openings, the bottom of the oven is sealed. From this arrangement very considerably increased efficiency has been found by the Company to result. The adjustable hotplate is a variant of the usual method, in which the distance between the top burners and the hotplate holding the vessel being heated is fixed. In the "Brentford" cooker, the hotplate is made separate from the top burners, and is fitted with a novel and simple adjustment by which the top can be raised or lowered at will to suit the flame which is produced by the burners under the conditions of combustion due to the composition and pressure of the gas actually being used.

In addition, there is being shown by the Brentford Gas Company a specimen of another new patent cooker they are introducing. This is the "Regulus No. III.," which embraces the features just mentioned, but has the oven so arranged that its greatest dimension is in width, and not height, so that a very large cooking space is available. It has been designed as a high-grade cooker suitable for medium-sized houses, is of handsome appearance, and is mounted on a white enamelled stand. Double doors are provided, and it is only necessary to open one when inspection of the oven is required. The enamelled sheets inside the oven are fixed without any screws showing through, and the top has a removable inner crown, which can be taken out for washing and cleaning. The arrangement of the oven also permits of a considerably larger hotplate being employed. The taps are strong, and a removable gas-injector is fitted.

Water heating by gas is also well represented on the stand. There is, in the first place, a Potterton set, with circulation, supplying the sinks, &c., that are in use. The plant shown is the new "H" series "Victor" boiler No. 92, with storage tank, circulation, and cut-out valve upon the "Victor" system, comprising No. 921 complete set. There are also Edgar "Instanter" and "Waterloo" geysers, both constructed on the "sealed" system—*i.e.*, the water flowing through the interior is isolated from the products given off by the burning gas. The first, provided with a spray attachment, is fitted over a bath. An interesting display is completed by specimens of sulphate of ammonia, special tar compounds for roads, &c.

The Falkirk Iron Company, Ltd., show the "Smoothtop" gas range, which is made in small sizes for private houses and in large form for hotel and restaurant use. This range has a closed top, that retains the heat, and can be kept hot all over with a small consumption of gas. The cabinet range for household use is on a stand, and has white enamel door panels. There is an automatic top-burner lighter; and the stove is designed to save floor space. The oven lining has a baked aluminium rust-resisting finish.

Messrs. Potterton have also fitted for the Staines Kitchen Equipment Company on their stand (which is devoted to culinary work in general, and their special arrangement for dish washing, &c.) a complete apparatus No. 931A. This is another working exhibit which should be of considerable interest to the industry. Elsewhere in the exhibition are to be found a number of other specialities in which gas is utilized, some of which have been noticed in our pages on previous occasions. Of the one-burner or gas-ring type are the "Cookall" oven and the "Gassaver" patent cooker. There are "Stott" governors, urns, coffee-making machines, &c., "National" gas-engines for a variety of purposes, and "Vitreosil" heat-proof gas-globes and mantle protectors by the Thermal Syndicate, Ltd. Cooking and heating by surface combustion are also demonstrated by Radiant Heating, Ltd.; and Messrs. Thomas and Bishop show their jointing material "Permac," and other goods.

The Pacific Coast Gas Association will hold their convention at Santa Barbara from Sept. 19 to 22. The programme provides for a part of the time at disposal being devoted to each of the various interests that constitute the Association. There is a total Association membership of 745.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Visit to the Wigan Coal and Iron Company's Sovereign Pit.

Over forty members of the Association took part, last Wednesday, in a visit to the Sovereign Pit at Westleigh of the Wigan Coal and Iron Company, Ltd. The party assembled at the offices, where they were received on behalf of the firm by Mr. Dobbs (Manager), Mr. Hill (Assistant General Supervisor), Mr. Shaw (Assistant Manager), and Mr. Hurst (Underground Manager). The General Superintendent of the Collieries (Mr. T. G. Dobb)—some notes by whom on coal and coal working, prepared in anticipation of the visit, appeared in the "JOURNAL" for Aug. 30 (p. 476)—had unfortunately been called away on business. The gentlemen named were the conductors of the party round the surface workings and pit No. 3, which has been working for a period of twenty years. Steam is generated by nine Lancashire boilers working at pressures of 100 and 80 lbs. per sq. in. The screening plant, consisting of shaker, jigging screen, and picking belts, was looked at with great interest. These pits have a total output of about 800 tons per day, the Arley and Yard being responsible for about 600 tons, and No. 1 pit for 200 tons per day. In the engine-house the winding plant was closely inspected; and the signalling apparatus and indicator showing the engine man the exact position of the cage down the shaft were noticed.

From here the party proceeded to the pit shaft, and were lowered down in groups. On landing, the parties, accompanied by a technical guide and two firemen, proceeded along the main road towards the coal face. Before doing so, however, each lamp was tested to make sure that all was in order. A stop was made to see the engine-house, containing a 100 H.P. electric hauling plant; the roof and walls of the house being of concrete. Later was seen the "iron man" or coal-cutting machine. The remarkable feature of this pit is the clean dividing line between the rock and the coal. The whole of the underground workings seen were quite dry, with a single exception of about three yards or so, where there was trace of water on the main road.

After the inspection, the visitors adjourned to tea, generously provided by the Company, at the Conservative Club.

The PRESIDENT (Mr. G. Dixon, B.Eng., A.M.Inst.C.E.) called upon Mr. J. H. CLEGG (Burnley) to move a vote of thanks to the Company, the guides, and all others for their kindness and hospitality that afternoon. Mr. P. GREENHOUGH (Hindley) seconded.

The PRESIDENT asked how the names of "Arley," "Yard," &c., were obtained. Was the coal as good to-day as in pre-war times?

Mr. DOBBS, in reply, expressed the pleasure they had had in conducting the members through the works and pit. With regard to the name of the coal, it was merely a local term. The Arley coal was a bottom seam of the series, and formed a natural horizon for the coal-field. Seams below this were usually too thin to work satisfactorily, but, when worked, were known as the Mountain Mine. The coal was as good to-day as before the war, and identical. Conditions varied from day to day, on account of falling roofs, &c.; but the main point was the "human element," which was not the same yet as in pre-war time. He thought they would eventually get back to it.

Mr. H. J. HAILSTONE (Rochdale) asked what governed the question of washing, and was told it was a decided advantage to wash, as the ash content was largely eliminated. Of course, washing cost money, and it was the market that really determined the position. Some seams would not sell unless the coal was washed. They washed about 6000 tons per week.

Mr. J. ALBINSON, B.Sc. (Manchester) pleaded that more research work should be done by the colliery companies on the ultimate composition and behaviour of the coals in use. He thought that the Company could put on the market a coal (in his opinion it would have to be a mixture) which would have a guaranteed behaviour for any definite purpose. He also thought that coal should be sold on a sliding-scale, bearing on the ash content or similar physical property.

Mr. DOBBS thought that the users of coal should carry out the necessary research on their own lines, as the colliery companies had usually sufficient to do to look after the production of the coal, bound as they were by stringent regulations on all hands. He reminded Mr. Albinson that a large amount of work had been done by the collieries.

When Summer Time Ends.—The shorter period of summer time prescribed by the Summer Time Act, 1922, does not operate this year. The Home Secretary has given notice that, in accordance with the Order in Council of March 15 last, summer time will not cease until 3 a.m. (summer time) on the morning of Sunday, Oct. 8, when clocks will be put back to 2 a.m.

Institute of Paint and Varnish Technologists.—It has been decided to have a dinner in London very shortly to inaugurate the Institute of Paint and Varnish Technologists, whose chief aims will be directed towards: (1) The dissemination of practical and scientific knowledge by the reading and discussion of papers. (2) Technical education improvements. (3) The formation of a technical library and reading room. (4) Maintaining close liaison with H.M. Government, public and professional bodies, institutions and societies interested in the products of the industry and problems of application. (5) Research. The Institute would work much on the lines of the American Society, which has already done valuable work in that country. A good response has been received from the industry; and all who are desirous of attending the dinner, or assisting, are asked to communicate with Mr. H. D. Bradford, No. 42, Ribblesdale Road, S.W. 16.

BRITISH ASSOCIATION FUEL ECONOMY COMMITTEE.

Fifth Report. Presented to Section B. (Chemistry) at the Hull Meeting, on Tuesday, Sept. 12.

THE following is the text of the fifth report of the Committee of the British Association for the Advancement of Science. The Committee were appointed for the "Investigation of Fuel Economy, the Utilization of Coal, and Smoke Prevention." The members of the Committee are:

Prof. W. A. Bone (Chairman), Mr. H. James Yates (Vice-Chairman), Mr. Robert Mond (Secretary), Mr. Robert Armitage, M.P., Mr. A. H. Barker, Prof. P. P. Bedson, Dr. W. S. Boulton, Prof. W. E. Dalby, Mr. E. V. Evans, Dr. W. Galloway, Mr. J. E. Hackford, Sir Robert Hadfield, Bart., Dr. H. S. Hele-Shaw, Mr. D. H. Helps, Dr. G. Hickling, Mr. A. Hutchinson, Mr. S. R. Illingworth, Principal G. Knox, Prof. Henry Louis, Mr. H. M. Morgans, Mr. E. Myers, Dr. J. S. Owens, Mr. W. H. Patchell, Mr. H. Stafford Rayner, Mr. L. L. Robinson, Mr. A. T. Smith, Dr. J. E. Stead, Mr. C. E. Stromeyer, Mr. W. C. P. Tapper, Mr. W. Thorneycroft, Prof. W. W. Watts, and Mr. C. H. Wordingham.

I.—THE COAL SITUATION.

Since the Committee last reported,* the fuel situation in this country has been dominated by the effects of the coal crisis of 1921. The output of coal from mines in Great Britain during the year ended Dec. 31, 1921, fell to 163 million tons, of which 24·66 million tons were exported, and a further 11 million tons (including about 133,000 tons of manufactured fuel) were consumed by steamers engaged in the foreign trade. There were also exported 443,565 tons of gas coke, 850,074 tons of manufactured fuel, and 292,648 tons of other sorts of coal fuel. Owing to the coal stoppage, there were imported into the country during the year (but chiefly during the three months April-July inclusive) altogether some 3·433 million tons of coal, and 136,424 tons of coke and manufactured fuel.

In the last report, the Committee drew attention to the effects of the then high coal prices upon the prospects of the iron and steel industry in this country; and as this particular industry reflects almost better than any other the effects of coal prices upon production, the following observations may appropriately be made upon the present situation. The crisis of last year in the coal trade was the final cause of the severe depression which in the pig-iron and steel trade had gradually been setting in since the miners' strike in the autumn of 1920. The latter came upon the trade following a period of high prices and abnormally high demand, and precipitated a complete cessation of business and great difficulty in obtaining new orders. This was further accentuated by the general post-war economic conditions in the world's markets. At the same time on the Continent there was a cheapening in the cost of production, together with a serious drop in exchange values and pressure of the banks on the Belgian and French works to realize stocks, and in consequence the foreigner was enabled to deliver pig-iron into Great Britain at a lower price than it could be made at home. Hence, while the pig-iron sales had been maintained fairly well up to the end of 1920, the first months of 1921 saw the importation of both pig-iron and steel into Great Britain on a large scale; foreign pig-iron being delivered into Scotland about 30s. per ton below the cost of manufacture in Great Britain. The coal crisis of the following months completed the disaster.

The combined effect of these various causes is well shown by contrasting the production of pig-iron and steel in the United Kingdom in the years 1920 and 1921 respectively. During the year 1920 the output of pig-iron was 8,034,700 tons, and of steel 9,067,300 tons; whereas in 1921 these figures had fallen to 2,611,400 and 3,625,800 tons respectively. The following analysis of the corresponding productions for each quarter of 1921 is very instructive in this connection:

—	Pig-Iron.	Steel.
	Tons.	Tons.
January-March	1,491,700	1,336,000
April-June	74,700	79,000
July-September	262,700	980,600
October-December	782,300	1,230,200
	2,611,400	3,625,800

On operations being resumed at the mines, production at iron and steel works restarted on a very restricted scale, and with the low prices then prevailing was carried on at a heavy loss. Despite subsequent reductions in wages due to the operation of sliding-scales and other mutual arrangements, and in the excessively high railway rates, which gave manufacturers less relief than had been hoped for, there still seems little chance of further reductions in the present prices of pig-iron and steel, the cost of fuel delivery to the works being still too high.

From a fuel economy point of view, the position is most unsatisfactory, because at present the prices of coke as compared with those of coking coals delivered at the works offer little inducement to iron and steel makers owning self-contained plants to start-up the coke-ovens connected with their steel-works, since coke can be bought at prices below the cost of making it in their own ovens, even after crediting the values of all the bye-products produced in the process. This condition is entirely abnormal; and it is hoped that with improved general trade, freedom from industrial disputes and unrest, and an increase in demand, more blast-furnaces and steel-works will be put into operation, and that the demand for the raw materials will then tend to re-establish more normal conditions in the coal and coke trade, and thus restore the balance in favour of pursuing a policy that ensures the greatest fuel economy in the operation of plants, which is so desirable in the national interests.

* See "JOURNAL," Vol. CLV., p. 656.

II.—OIL FUEL SUPPLIES—PRESENT AND FUTURE.

The Present Situation.—During the past year the Committee have had under consideration the important question of present and future supplies of oil fuel which are now needed for certain purposes (chiefly motor transport) for which at present coal cannot well be used. In this connection they have had the valued help of Mr. J. E. Hackford, who was co-opted on to the Committee on the nomination of the Institution of Petroleum Technologists.

As a first step towards the exploration of the subject, the Committee decided to collect authentic information as to the importation of petroleum products into the United Kingdom during each of the five years 1917-1921 inclusive. For purposes of reference, the data so collected have been analyzed and tabulated as follows:

TABLE I.—*Imports of Petroleum Products into the United Kingdom for the Years 1917 to 1921 inclusive.*
(*Tons.*)

—	1917.	1918.	1919.	1920.	1921.
Crude oil	1·65	—	31,388·0	17,417·1	426,151·0
Lamp oil	456,995·4	528,644·6	544,185·0	574,828·2	536,575·6
Motor spirit	422,030·9	584,724·3	602,324·8	629,511·5	768,287·5
Lubricating oil	351,188·0	409,095·2	263,332·0	426,656·0	204,059·8
Gas oil	120,400·0	149,375·0	115,511·1	206,018·4	304,736·6
Fuel oil	1,835,759·1	3,515,020·8	1,105,855·0	1,425,045·6	2,255,822·2

The Committee then proceeded to inquire into the origins of our present imported oil fuel supplies, and for this purpose the statistics for the year ending 1921 were analyzed (see Table II.) so as to discriminate between the various countries of origin, and also to show how much of our total imported supplies of petroleum and petroleum products are being drawn from within the Empire itself.

The Committee consider it important that attention should be drawn to the fact that, inasmuch as the home production of shale oil is now very small*, owing to the relatively low cost of production of imported petroleum, we are at present dependent almost entirely on countries outside the Empire for the supplies of natural petroleum and petroleum products—a most undesirable and dangerous state of affairs from every point of view.

The Gas and Coking Industries as Producers of Motor Spirit.—It would appear that the only practicable way in which future home supplies of motor spirit and fuel oils can be extended is by the carbonization of bituminous coals at temperatures between 600° and 1200° C. By carbonizing suitable British coals at high temperatures (1000° to 1200° C.) in gas-retorts or bye-product coke-ovens, there can be obtained between 3 and 6 p.ct. of the weight of the dry coal as anhydrous tar, and between 0·75 and 1 p.ct. of its weight as refined benzole (motor spirit). It should be borne in mind, however, that, inasmuch as more than half of the coal so carbonized is for the production of hard metallurgical coke, the total production of motor spirit and tars by these methods depends very largely upon conditions in the iron and steel industries which fluctuate, and at the present time are exceedingly bad. Supposing, however, that pre-war prosperity were restored to the iron and steel industries, a total high-temperature carbonization of some 40 million tons of coal per annum might reasonably be expected. Taking 1 p.ct. of its weight as a probable outside limit for the ultimate production of refined benzole, the total potential production of the latter would not exceed 400,000 tons per annum, which is very little more than half the tonnage of the motor spirit actually imported into the country in the year 1921. Moreover, of this potential supply nearly half would have to be

* Thus in the year 1920 the amount of oil shale mined in Great Britain was 2,840,859 tons, from which it may be estimated that no more than about 227,000 tons of oil would be produced.

TABLE II.—*Imports of Petroleum Products for the Year ended Dec. 31, 1921.*

[Customs corrected returns in tons, to the nearest decimal place.]

Origin.	Motor Spirit.	Kerosene.	Lubricating Oil.	Fuel Oil.	Gas Oil.	Crude Oil.	Others.	Total.
U.S.A.	414,165·7	440,410·6	192,185·3	820,610·4	292,181·3	7,533·9	300·5	2,167,387·7
Mexico	68,430·9	59,182·7	13,011·4	1,129,758·3	996·5	61,982·6	..	1,333,362·4
Dutch E. Indies	109,211·1	..	0·5	8,943·7	..	..	..	118,155·3
Dutch W. India Islands	5,649·3	..	..	..	..	..	..	5,649·3
Poland	..	..	19·8	..	2,184·0	..	..	2,203·8
Peru	9,092·9	..	..	..	..	..	..	9,092·9
Roumania	9,426·7	20,900·5	..	..	..	6·0	..	30,333·2
Russia	..	4,771·3	1,372·0	..	..	..	..	6,143·3
Persia	117,654·7	..	..	178,263·9	..	350,650·4	..	646,569·0
Other Foreign Countries	0·2	70·3	1,465·5	31,731·1	374·8	13·2	16·6	33,671·7
Total from Foreign Countries	733,631·5	525,335·4	208,054·5	2,169,307·4	295,736·6	420.186·1	317·1	4,352,568·6
British India	8,458·5	..	5·1	..	..	..	..	8,463·6
British W. India Islands	6,870·7	5,635·6	..	85,483·8	..	5,964·8	34·8	103,989·7
Canada	..	..	..	..	..	..	8·8	8·8
Egypt	6,314·4	5,605·1	..	1,042·0	..	..	..	12,961·5
Sarawak	10,571·8	..	..	..	..	..	..	10,571·8
Straits Settlements	2,439·5	..	..	..	..	..	..	2,439·5
Other British Possessions	..	..	0·2	..	..	..	4·4	4·6
Total from British Possessions	34,654·9	11,240·7	5·3	86,525·8	..	5,964·8	48·0	138,439·5
Total	768,286·4	536,576·1	208,059·8	2,255,833·2	295,736·6	426,150·9	365·1	4,491,008·1
Percentage from Countries outside the Empire	95·5	97·9	100·0	96·1	100·0	98·6	86·9	96·9

drawn from the gas-works of the country, and it is at least problematical whether it would pay the gas companies to extract the benzole from their gas at present prices. Indeed, taking the existing relative prices of gas and benzole, as well as the costs of recovering benzole from coal gas, it is probable that the cash value of the potential heating power of benzole is greater when left in the gas than it is when extracted therefrom and (after subsequent refining) sold as motor spirit.

Low-Temperature Carbonization of Coal as a Future Source of Oil Fuels.—Therefore, it has to be recognized that the most promising internal supply of both motor spirit and fuel oils lies in the direction of the low-temperature carbonization of coal, provided that methods can be devised for same which are sound both from the technical and the commercial points of view. A really successful solution of this problem is greatly to be desired, not only for the aforesaid reasons, but also because it would be a great factor in the abolition of the smoke nuisance, especially from domestic fireplaces. The Committee have paid close attention to the recent developments with regard to the matter which are taking place in this country. In this connection attention may be drawn to:

1.—The description of the operation of the experimental plant at Barugh, near Barnsley, as published in "Engineering" for Oct. 28, 1921.

2.—The conference on low-temperature carbonization which was held at Cardiff on April 20, 1922, under the auspices of the South Wales Institute of Engineers.

3.—The paper read on April 3 last on "The Influence of Structure on the Combustibility and other Properties of Solid Fuels," by Messrs. E. R. Sutcliffe and E. C. Evans, before the London Section of the Society of Chemical Industry ("Journ. Soc. Chem. Ind.," Vol. XLI., p. 196 T.).

4.—Report on Low-Temperature Carbonization recently issued by the Fuel Research Board (H.M. Stationery Office, 1922).

Taken together, these publications give a fairly comprehensive view of the present position of affairs in regard to the low-temperature carbonization in this country. The Committee are in general agreement with the view recently expressed by the Fuel Research Board that, although we have not yet reached the stage when a final answer can be given to the question whether or not it will be possible to establish on sound industrial lines a new industry based on the carbonization of the tens of millions of tons of coal per annum which are at present being consumed in the raw state in this country, yet, as the result of the pioneering work which has been done during recent years by various organizations, such knowledge and experience has been gained as affords some ground for the expectation that we are approaching a conditional solution of the matter.

There still seems to be some difference of opinion as to whether, from the commercial point of view, it will be better to carbonize at temperatures round about 600° C. or at somewhat higher temperatures (say, 700° to 750° C.); but this may be regarded as a minor issue. It seems now to be established, as the result of fairly large-scale trials, that the average yields of the various products now obtainable by carbonizing suitable British bituminous coals at a temperature of 600° C. will amount (on the weight of the dry coal carbonized) to about 7·5 p.ct. of tars, and about 2·5 gallons per ton of motor spirit, besides about 3500 c.ft. per ton of a rich gas of a gross calorific value (say) of about 800 B.Th.U.,* and a 70 to 80 p.ct. residue of smokeless semi-coke.

Seeing that the cash value of the semi-coke residue far exceeds that of all the other products put together, and that the price of fuel oil in this country will probably also be determined by circumstances beyond our control, it seems as though the ultimate prospects of a low-temperature carbonization industry will depend upon the price which the public will be willing to pay for a smokeless domestic fuel. There can be little doubt but that such a fuel, properly manufactured, is a very suitable one for domestic consumption. It burns freely and smokelessly, and also, according to Dr. Fishenden's recent experiments (*vide* Fuel Research Board Special Report No. 3), it has a greater radiant efficiency than either coal or high-temperatue coke. Its general adoption, however, will probably depend upon two other conditions being fulfilled. First, it must be prepared and distributed in a form which will allow of it being freely handled without undue disintegration. Secondly, if its ash content could be cheaply reduced to a low figure by subjecting the coal to some washing process, such as froth flotation or the like, before it is carbonized, its attractiveness as a domestic fuel would be undoubtedly greatly increased. Indeed, it seems possible that public opinion might soon be educated to regard with favour well-manufactured smokeless semi-coke of better combustibility and of smaller ash content than raw coal.

From this point of view, the recent work of Sutcliffe and Evans upon the influence of porosity on the combustibility of solid fuels* is of interest, inasmuch as it draws attention to a factor whose significance is not always sufficiently recognized in fuel technology. These authors consider the porosity of the cell walls of a carbonized fuel to be extremely important in determining its combustibility. Their suggestion that, before the coal is carbonized for the production of a free-burning smokeless fuel, it should be finely pulverized and briquetted by pressure without the use of a binder, in order that the thermal availability of the resulting semi-coke may be raised to a higher level, deserves further investigation from both the technical and commercial standpoints, especially if it could be found practicable to combine it with some preliminary washing process in order to reduce the ash content of the semi-coke.

Supposing that further technical developments result in the establishment of a low-temperature carbonization industry for the manufacture of a smokeless domestic fuel, it is of interest now to forecast the effect of such developments upon the future home supplies of motor spirit and fuel oils. It may be provisionally assumed that the amount of coal which could be so carbonized to supply domestic fuel requirements would be at least 40 (and possibly even 50) million tons per annum. Taking the former of these two figures, this would mean a possible production of about 100 million gallons (or about 350,000 tons) of motor spirit, and 600 million gallons (or about 2,750,000 tons) of anhydrous tars (fuel oils).

Present Tendencies in the Use of Oil Fuel.—Before the advent of the internal combustion engine, the term "fuel oil" was restricted to an oil intended to be burnt in furnaces and the like. In the early days of oil fuel practice, comparatively light oils were used. They were "atomized" and injected into the boiler furnace or the like by means of steam or air, and the burners used were often of a crude and unsatisfactory character. In recent years, however, more attention has been given to the proper design of such burners, and to the more effective combustion of the fuel oil. The consumption of air or steam by the oil burners has been considerably reduced, and, as they have attained a higher degree of mechanical efficiency, heavier oils have been successfully used in them. Methods have now been devised whereby heavy oils

* The Fuel Research Board's report gave figures which would average about 1000 B.Th.U.; but the Committee have thought it better to adopt here the more conservative estimate of 800 B.Th.U.

* See "JOURNAL," Vol. CLVIII., p. 439.

may be sprayed into the furnace under pressure alone, without the aid of either steam or air, and therefore it has become possible for heavy petroleum residues, such as asphaltum, to be employed as first-class fuels for land installations. A similar tendency has recently been manifested in the use of fuel oil in internal combustion engines. Until very recently petroleum refiners prepared a very light fuel oil for these engines; but mechanical research is now being directed in order to render them capable of burning even the heaviest oils. Progress in this direction has been greatly helped by scientific investigations upon the spontaneous ignition temperatures of fuel oils.

The outstanding question to-day is how to adapt a heavy fuel oil for use in low-compression internal combustion engines. This is now receiving the close attention of scientific investigators, and it may be hoped that as a result of their work the public will in due course be enabled to use heavy fuel in the place of motor spirit.

III.—The Chemistry of Coal.

Progress towards the solution of the problem of the constitution of coal substance can be recorded, notwithstanding the magnitude and complexity of the problem. The difficulties arise in no small measure from the absence from the products of such researches of bodies with crystalline habit or other well-defined physical characters by which the chemist is accustomed to identify the compounds he isolates. Still, the literature shows the subject has attractions for not a few chemists who, employing various methods of attack, seek to obtain information as to the nature of the multifarious compounds which go to the make-up of coal. As, however, different investigators select for their study coals of varying origin and of different classes, it is not always easy to compare the results obtained.

The work of Clark and Wheeler ("Trans. Chem. Soc." 1913, 103, p. 1704), combining the application of solvents with the study of the action of heat upon the extracts of the coal so obtained, has undoubtedly given much useful and valuable information. The results, however, still leave open to conjecture and theoretical explanation the true nature of the components of the several fractions. The classification of the coal components by Clark and Wheeler based upon the pyridine-chloroform treatment is too facile; nor could it be expected to provide material for a complete explanation of the properties of coal.

The breaking-down of a bituminous coal by treatment with a mixture of pyridine and amyl-alcohol yields an extract from which, by successive use of ether and light petroleum, Bone, Pearson, Sinkinson, and Stockings ("Proc. Royal Soc.," A, Vol. 100, 1922, p. 582), have succeeded in obtaining (1) a non-resinous wax-like substance, (2) a resin, to which the formula $C_{31}H_{32}O_8$ is assigned, (3) a portion, insoluble in ether, consisting of non-resinous material, partially dissolved by alcoholic potash; and this they designate as "humic substance." The authors are satisfied that these humic substances are not "resinic," but "cellulosic," in origin. The influence of these several fractions on the coking of a coal has been studied, with the result that, whereas the said resin is in part responsible, the main cause of the coking propensities was shown to be a series of substances of "humic" type, which are soluble in chloroform, but not in ether, and whose fusion temperatures are below those at which they undergo rapid decomposition.

The acidic substances extracted by alkalis from the aforesaid humic bodies are precipitated by acids from these solutions as bulky, dark-coloured, opaque jellies. These jellies on drying form black, brittle, lustrous, and structureless masses, with conchoidal fractures, suggestive of the material forming bright coal which Stopes has styled vitrain. The consideration of these facts has led Bone and his co-workers to suggest that "bright coal" may have originated in a colloidal gel.

In this connection attention may be directed to a like conclusion arrived at by Dr. J. A. Smythe in 1906, in a paper read before the University of Durham Philosophical Society,* which dealt with certain "Peaty Deposits from a Pit-Fall at Tantobie, County of Durham." Among the substances described is a black jelly-like body, which Smythe styled "black-stuff;" and this he showed by its composition and behaviour to solvents, notably to pyridine, suggests a similar relationship to bright coal.

It has long been recognized that bituminous coals contain three easily distinguishable components, which until recently had usually been designated (*a*) mother-of-coal, or mineral charcoal, (*b*) dull hard coal (Ger. = "Mattkohle"), and (*c*) bright coal (Ger. = "Glanzkohle"), respectively; the last named being a structureless, lustrous substance with a conchoidal fracture. Recently Stopes ("Proc. Royal Soc.," B. 90 (1919), p. 470) proposed new names for them; (*a*) fusain, (*b*) durain, while (*c*) is termed by her either clarain or vitrain, according as it does or does not contain recognizable plant tissues and structures. In putting forward these proposals, Stopes recognized that none of the four said ingredients (with the possible exception of vitrain) are either homogeneous or chemical molecular units, also that they do not even approximately represent the crystals in a petrological section of a rock. Provided that such qualifications are kept clearly in mind, and that it be realized that clarain may prove to be merely vitrain in which plant structures occur in suspension, the Committee see no great objection to the provisional substitution of the proposed new names for the older ones, regarding the matter more as one of convenience than as involving any new principle.

The Committee also feel that the growing practice among coal chemists to use the terms *alpha*, *beta*, *gamma*, &c., to designate the several components obtainable from the coal substance by fractional extraction of it by means of various solvents, is one which, unless regularized in some definite way, is likely to lead to much confusion and obscurity, to the detriment of progress. It is obvious that coal may be "fractionated" in as many different ways as there are suitable solvents and modes of applying them; and therefore unless, as the results of some particular treatment or procedure, components of a reasonable degree of purity and well-defined properties are isolated, it is undesirable that definite names should be assigned to them, as though they were the actual chemical constituents of the coal instead of unknown mixtures of them. The Committee therefore would suggest that the time has come when chemists should agree in conference upon some common plan of labelling such "coal fractions" which, while recognizing them to be such, shall also in some way indicate how they have been obtained.

Supposing, for example, that a particular investigator extracts a coal with two solvents A and B, he might designate the fraction which is insoluble in both as the α AB fraction, while β AB might be used to denote the fraction which is soluble in A but not in B, and the γ AB that which is soluble in both A and B, assuming all solvents to be used at their respective boiling points, at atmospheric pressure. Thus, a fraction termed the "α pyridine-chloroform" fraction would mean the residual insoluble portion of a coal after successively extracting it with pyridine and chloroform at their respective boiling points; the "β pyridine-chloroform" fraction would be that portion of the pyridine extract which is insoluble in chloroform; while the "γ pyridine-chloroform" fraction would mean the portion of the coal which is soluble in both pyridine and chloroform, and so on. In cases where the coal is extracted at some particular temperature other than the boiling-point at atmospheric pressure of the solvent employed, the actual temperature used might be designated by putting it in small type above the name of the solvent, thus: "Benzene $^{120°}$," denoting that benzene had been used at 120° C.

IV.—Brown Coals and Lignite.

Although Great Britain itself is almost destitute of sub-bituminous coals and lignites (the Bovey Tracey deposit in Devonshire being the only important one in this country), the problem of using them efficiently is of great importance to several of the Dominions, and especially so to Australia, Canada, and India. Of the total estimated Canadian reserves, amounting altogether to 1,234,268 million tons, no less than 1,072,627 million tons are of a sub-bituminous lignitic class occurring in the upper cretaceous formations of the province of Alberta, while in the neighbouring province of Saskatchewan there are both cretaceous and tertiary lignite reserves amounting to 59,812 million tons. The Dominion Government have set up a Lignite Utilization Board for the purpose of investigating the best means of utilizing these resources, and it is hoped that the approaching meeting of the Association at Toronto in 1924 will afford an opportunity of discussing the problem in all its bearings.

In Australia, the provincial Governments of Victoria, South Australia, and New South Wales are all interesting themselves in the utilization of their brown coal and lignite resources. Of these, the celebrated Morwell deposit in the Gippsand district of Victoria (which are of phenomenal thickness without parallel elsewhere in the world) are of great scientific interest, as well as of economic importance for the future of Australia. It has been estimated that within an area of 50 square miles in the Latrobe Valley, and within 1000 ft. of the surface, there are 31,144 million tons of the coal. A borehole put down near Morwell disclosed no fewer than seven beds of brown coal within 1000 ft. of the surface, of a total thickness of 781 ft., the individual seams (taken in order from the surface) running 29 ft. 8 in., 25 ft. 8 in., 23 ft., 227 ft. 10 in., 265 ft. 6 in., 166 ft., and 43 ft. 8 in. respectively. So far as they have been examined, they were reported by the Victorian Advisory Committee on Brown Coal, in 1917, as consisting of "a matrix of earthy brown coal, with sporadic inclusions of lignite. . . . The matrix consists of pollen grains, spore cases, and decomposed vegetable matter. . . . The coal varies in colour between yellowish brown and black, but it always pulverizes to brown powder." The raw coal usually contains about 50 p.ct. of water. The dry coal contains: Carbon, 62·5; hydrogen, 4·85; nitrogen, 0·45; sulphur, 0·20; oxygen, 28; and ash, 4 p.ct. Its gross calorific value is about 6500 K.C.U. per kg.

In the year 1917 the Advisory Committee appointed by the Victorian Government to investigate the possibilities of generating electric power on a large scale from the Morwell coal, reported that, notwithstanding its low grade, power could be more cheaply generated from it for the City of Melbourne than from black coal imported from New South Wales. It has been officially estimated that the cost of producing raw Morwell coal at the mines will not exceed 2s. 6d. per ton. The Victorian Government have already authorized the expenditure of £6,000,000 upon the development of the Morwell coal deposits, in the expectation that by the year 1924 electrical energy from there will be supplied not only to the City of Melbourne, but also throughout the whole state of Victoria. It has been calculated that the cost of such energy at the mine will be as low as £2 17s. 6d. per horse power per annum, and that it can be sold profitably to manufacturers

* "University of Durham Philosophical Society Proceedings," Vol. 2, pt. 6.

throughout the State at an average price of £4 8s. per horse power per annum. Large-scale steam trials are, or have been, in progress with a view to ascertaining how the coal may best be burned under boilers, and a large electric power station scheme at Morwell is rapidly materializing. A big order for water-tube boilers in connection therewith has recently been placed in this country.

The problem of how such low-grade fuel as brown coals and lignites can be most efficiently burned under boilers has therefore become one of great importance. It is obvious that a prime condition of efficient combustion is that coal shall be dried before being burnt; and as this drying can be effected at the expense of some of the sensible heat in the waste gases from the boiler, provided that they contain not less than 10 p.ct. of carbon dioxide, such a drying operation may be cheaply carried out as an integral part of the boiler operation. Whether or not, as an addition to this drying operation, the coal should be subjected to a preliminary low-temperature carbonization, using the residue therefrom as the boiler fuel, is a matter for future investigation to decide. In this connection attention may be drawn to the recent discovery made by Bone ("Proc. Royal Soc.," A., Vol, 99, 1921), while investigating Morwell brown coal and Saskatchewan and other typical lignites:

(*a*) That there is for each particular brown coal or lignite a certain definite temperature limit (usually between 300° and 400° C.) up to which it may be heated (in the dry state) so as to effect a considerable chemical condensation in its cellulosic or humic constituents, with simultaneous expulsion therefrom of steam and carbon dioxide, together with a small but variable proportion of carbonic oxide; and that such chemical condensation is unaccompanied by any other change productive of either hydrogen or hydrocarbons.

(*b*) That, by means of such condensation, substantially the whole of the potential energy of the fuel may be correspondingly concentrated by suitable heat treatment (within the prescribed temperature limit) in the resulting carbonaceous residue, which may therefore be burnt with greater calorific intensity than the original coal.

(*c*) That, accordingly, such treatment constitutes a possible means of up-grading brown coals and lignites generally, thus improving their fuel values.

(*To be continued.*)

THE FUNCTION OF PURE SCIENCE IN THE FIELD OF INDUSTRY.

By A. R. MYHILL, A.I.C.

WHILE there is no occasion to belittle the value of technical training, or to ignore the great value of research in applied science, there are indications in some quarters that there is a tendency to undertake experimental work, without basing it on sound theoretical principles. There is a danger in this—a danger of wasting time and energy. In nothing, perhaps, is the counsel to "hasten slowly" so true as in the case of the application of science to industry. Any attempt to make assumptions, to "stretch" theories, or to build before examining the foundations, is likely to lead to disappointment and to waste of time and money. The pendulum has oscillated from the times of Boyle and Lavoisier, when the energy of scientific workers was directed to the investigation of principles, to the present day, when the main body of our scientists are engaged in applying these principles to practical ends. A far-seeing observer might visualize a return of the pendulum's swing, when our researchers realize that the discovery of more basic knowledge and of further fundamental natural laws has become essential to continued progress.

This is undoubtedly becoming recognized in the industrial world, and must, in time, become further emphasized. While there are very large numbers of firms and associations maintaining research workers in applied science, there are a few (and their numbers are growing) who consider it worth their time and money to support the pursuit of pure knowledge. Such knowledge is, probably, more likely to benefit industry in general than to be to the advantage of any particular firm or trade, so that a co-operative system, adopted by a trade association, is probably the most economical in the long run.

The firm grasp of the theoretical side of the operations involved in industry will often save years of labour on the part of the technical worker. There must be thousands of instances of patient and hardworking endeavour, creditable as evidences of perseverance and optimism, but nevertheless hopelessly doomed to failure because of the wrong line of attack taken in the attempt to elucidate the problem under consideration. That the particular line of attack is a wrong one would be plain at once to an onlooker whose knowledge was firmly grounded on basic principles. One has only to look through the files of the Patent Office and to notice, for example, the thousands of "perpetual motion" machines, to realize the huge numbers of inventors, calling themselves scientists or engineers, whose knowledge of mechanics (if present at all) could not possibly have reached a grasp of Newton's Laws of Motion. Yet such workers will consider the time well spent which is occupied in such matters as, for instance, the problem of the ease of running of a shaft, or the material of construction of a certain part, oblivious to the fact that their house is built upon the sand and, as a consequence, inevitably doomed to destruction.

In his recent book "Science for Life," Prof. J. A. Thomson makes the position of *discoverers* (as distinguished from *inventors*) very plain. He rightly says that there is a danger of diverting the real discoverer from the pursuit of knowledge to the, perhaps, easier, and certainly (as a rule) more remunerative, work of applying knowledge to practical ends. One of the methods of minimizing this danger is by the education of the public, and by providing inducements for attracting the right kind of man. Such inducements are not, and never have been, so great as they might be. Let us hope that a more enlightened future may remedy this, as indeed it must if progress is to be made possible.

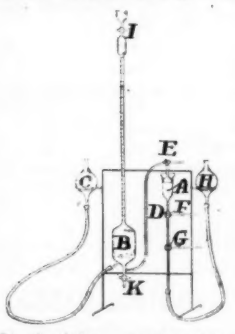
In the realm of chemistry and physics there are, as far as the application of the sciences to industry is concerned, many lines of investigation which must be admitted to be "shots in the dark." Experiments are tried, suggestions hazarded, and inventions protected which are not always based on logical reasoning from first principles. The realm of colloid chemistry is one which must be developed to a much greater extent than hitherto. The relation of inorganic catalysts to living organisms may feasibly throw much light on problems at present little understood. The closer investigations of the laws of biology may (probably will) prove the solution of the question of conserving our supplies of fuel for internal combustion engines, since it is surely more scientific to reproduce potential sources of power by natural means than to use up those reserves which nature has stored in very limited quantity.

The pursuit of such knowledge as is indicated above, although at first sight of theoretical value only, will doubtless in the end result in revolutional advances in industrial practice.

DETERMINING THE SPECIFIC GRAVITY OF COKE.

"Glückauf" for Aug. 12 contained an account by A. Schmolke, of Breslau, of an interesting method of determining the real and the apparent specific gravity of coke. The author briefly discusses the merits and the failings of the various known methods. But, he points out, samples of coke from the same coal, and even from different parts of the same chamber or retort, may so vary in character that it is necessary, in determining the specific gravity, to take the average of a number of tests. For this reason he has worked out what he claims to be a very simple and accurate method. When coke is used for firing, it comes into contact only with air and with the combustion gases. In the same way, in the present method of determining the real specific gravity, the coke has contact only with gas and air. The samples are taken without any special preparation, just as they occur when large pieces are broken up.

The principle of the process consists in playing a gas, the specific gravity of which is higher than that of air, on the coke, contained in a suitable receptacle, until the air surrounding the coke and contained in it is all replaced by the gas. The quantity of air is measured after absorption of the gas used. The nature of the apparatus employed can be seen from the accompanying diagram, in which A is the receptacle for the coke sample. An absorption vessel B is surmounted by a closely graduated pipette, and connected with C for adjusting levels. In the connecting tube D between A and B is the three-way cock E, with an angle-bore, and a connection through the stopper with the open air. The coke container A consists in a smaller fixed upper portion, and a larger part, slightly wider, which is movable to admit the sample. They are, of course, made to fit air-tight. A glass tube, in which are the three-way cocks F and G, and a rubber tube connect the movable part of A with the mercury pressure vessel H.



Before the test, B and C are filled with 1 : 3 caustic potash, which, by raising C, is made to rise to half-way up the funnel. The cock I is then closed. At the same time the tube D becomes filled with caustic potash; the air it contained being allowed to escape through the boring in the stopper of E. The space round the upper part of A formed by the funnel-shaped extension of the lower part is filled with water. Any escape of air during the experiment can thus at once be detected. Before every test, a vacuum pump is connected with G, and, by closing the angle-bore at E and adjusting the cocks F and G, air is drawn through A for a few minutes. Then A is connected with D through the angle-bore. The displacement of the air in A is then effected by means of carbon dioxide, which must be completely free from air, introduced at F. [The gas can be tested for impurities by passing 500 c.c., which is quite sufficient for one experiment, through the cock E into the absorption vessel B.] The container A is shut-off at F, and, to clear the tubes and the bores of the cocks F and G of air, carbon dioxide is run for a few seconds, and escapes at G. By reversing the cock G, the carbon dioxide is sent into A, from

which the air is driven and carried to the absorption vessel with the carbon dioxide stream. After absorption of the latter, the volume of air previously contained in A is found in the graduated tube. Corrected to normal temperature and pressure, this volume is retained as the "constant" for the apparatus. This constant is easily checked. In the same way as at first described, the carbon dioxide is extracted from A by means of the vacuum pump. After reversing the cocks F and G, mercury is run in up to F, A is connected with D, and mercury allowed to rise to E, until the angle-bore is filled with it. Should any of the mercury escape into the connecting tube D, it can be let out through the cock K. In this way the air is driven into the absorption vessel, except for a small remnant in the tube D. This can be cleared by carbon dioxide introduced at E. After 15 minutes a reading is taken, which should agree with the previous reading obtained with carbon dioxide.

In a similar manner the actual coke test is carried out. The sample is introduced, and the apparatus prepared as for the determination of the constant already described. The 500 c.c. of carbon dioxide are then passed through the container holding the coke, fairly quickly at first, and then slower, so that perhaps two or three bubbles go through the caustic potash per second. When the air surrounding the coke has been driven off, diffusion takes place between the air in the pores of the coke and the continuous stream of gas. Many experiments have proved that the specifically heavier gas, introduced from below, displaces all the air, even in the densest coke, within five minutes. It is best regulated so that 500 c.c. of carbon dioxide pass through in ten minutes, speeding-up the flow towards the end. Burette readings should be taken only after allowing 15 minutes for the caustic potash to settle. To test the accuracy of any one experiment, the carbon dioxide can be withdrawn from A and the coke in it by means of the vacuum pump, and the test repeated. Readings should agree within 0·025 c.c. Corrections for temperature and pressure should, of course, be made in each instance.

The determination of the apparent specific gravity can be made with the same sample, by measuring the volume of air displaced when the coke in the container is surrounded with mercury. The carbonic acid remaining from the last experiment is first of all removed by the vacuum pump, and mercury brought up to the cock F. After connecting A and D, the mercury is made to rise up to the cock E, thereby expelling the air which surrounded the coke. The residue of air in the tube D is, as before, driven out by the passage of carbon dioxide gas. At times, especially with very porous coke, mercury penetrates the sample. For this reason the sample is weighed before and after the test, and the volume of mercury absorbed is calculated and brought into the reckoning.

The weight of the coke sample taken, divided by the difference between the constant and the volume of air displaced in the test by carbon dioxide, gives the real specific gravity. The quotient of the weight of coke divided by the volumetric difference in the mercury test, gives the apparent specific gravity. The latter, divided by the real specific gravity, and multiplied by one hundred, gives the density of the coke, and, by subtraction, the porosity per cent.

To take an example, assume that the coke sample weighs 8·381 grammes, and that the constant found for the apparatus was 49·10 c.c. (all volumes reduced to N.T.P.). If the volume of air displaced by carbon dioxide was 44·36 c.c., then the

$$\text{Real S.G.} = \frac{8{\cdot}381}{49{\cdot}10 - 44{\cdot}36} = 1{\cdot}768$$

If the volume of air displaced by mercury was 40·30 c.c., then the

$$\text{Apparent S.G.} = \frac{8{\cdot}381}{49{\cdot}10 - 40{\cdot}30} = 0{\cdot}950$$

$$\text{Coke density p.ct.} = \frac{100 \times 0{\cdot}950}{1{\cdot}768} = 53{\cdot}73$$

$$\text{Porosity p.ct.} = 100 - 53{\cdot}73 = 46{\cdot}27$$

The apparatus is supplied by a Breslau glass firm.

THE SEPARATION OF HIGH CALORIFIC GASES FROM CRUDE COAL GAS.

The adsorbent effect of active carbon on certain constituents of coal gas, which has been the subject of two articles translated from the German for the "JOURNAL" recently [March 22, p. 701, and Aug. 23, p. 421], with particular reference to benzole extraction, appears to be creating considerable interest in Germany. In "Brennstoff-Chemie" for May 15, Fischer, Schrader, and Zerbe discuss the possibility of another application of the same principle, which, though its practical usefulness has still to be proved may be of suggestive interest to the gas chemist.

The higher their calorific value, and the greater the proportion of them which liquefies under moderate pressure and at ordinary temperatures, the greater is the economic value of the storage of gases, destined for lighting, heating, or other purposes, in steel cylinders. The authors mention, as examples of such gases, the well-known commercial "Blaugas," obtained in Germany from the heavy hydrocarbons of oil gas, and the liquefied gas obtained from natural gas in America by simultaneous pressure and cooling. A German firm are trying to put on the market methane condensed at 125 to 150 atm. But methane has the disadvantage of not liquefying at ordinary temperatures, so that only comparatively small quantities can be stored in a cylinder. And secondly, its calorific value is low in comparison with its homologues. The article envisages crude coal gas and coke-oven gas as potential new sources of gases for the purpose; but the quantities of suitable hydrocarbons available in them are too small to render profitable their recovery by pressure and cooling. It is therefore suggested that, as active carbon is able to take the vapours of certain fluids, such as benzene, out of gas mixtures, so it might with advantage be used to take up the lower members of the aliphatic hydrocarbon series, which exist in gaseous form at ordinary temperatures; the effect being enhanced by pressure. The article deals with experiments conducted with a view to testing this theory, using on the one hand crude coal gas, and, on the other, coke-oven gas.

The coal gas used gave the following analysis:

	P.Ct.
Methane and homologues	57·4
Hydrocarbons removable with fuming H_2SO_4	5·2
Hydrogen	16·7
Carbon monoxide	6·2
Carbon dioxide	7·0
Nitrogen	3·1

The gas was contained in a steel cylinder of about 40 litres [1·41 c.ft.] capacity, under pressure of 20 atm., and the object was to prove whether, by means of active carbon, it could be divided into fractions of various calorific values. The active carbon, weighing 698 grammes, was contained in a cylindrical steel vessel of 2·6 litres capacity, provided with a valve at each end. It was placed vertically, and the top valve was connected by copper tubing with the gas cylinder, the lower by rubber tubing with a meter. A pressure gauge was introduced at the outlet of the gas-cylinder, and the top valve of the carbon cylinder was opened fully, so that practically the same pressure existed in the carbon and gas cylinders. By means of the lower valve of the carbon cylinder, gas was allowed to flow out at a regular 6 litres [0·212 c.ft.] per minute, and at this outlet samples were taken at intervals.

The gas was allowed to flow until the pressure was reduced to 12 atm., the quantity for this amounting to 350 litres [12·358 c.ft.]. Then the valve between the two cylinders was closed. It was then sought to prove whether the carbon had acted in the expected manner, by taking calorific values of the gas which left the carbon cylinder on opening the outlet valve, amounting to 30 litres [1·059 c.ft.], and of the further quantity, amounting to 33·5 litres [1·183 c.ft.], which was obtained by heating up the carbon to 300° C. The results obtained are shown in the following table. [One litre = 1000 c.c. = 0·3531 c.ft.]

No.	Description of Sample.	B.Th.U. Per C.Ft.
1	Crude coal gas used	823
	Crude Gas after Passing through Carbon under Pressure:	
2	Quantity passed 100 l. [3·531 c.ft.]	613
3	,, ,, 200 l. [7·062 ,,]	663
4	,, ,, 300 l. [10·593 ,,]	681
5	,, ,, 350 l. [12 358 ,,]	710
	Gas Subsequently Blown out of Carbon Cylinder:	
6	After blowing-out 20 l. [0·706 c.ft.]	886
7	,, ,, ,, further 10 l. [0·353 c.ft.]	1017
	Gas Driven out of Carbon by Heating:	
8	Heated to 50° C.	1089
9	,, from 50° to 75°	1259
10	,, ,, 75° ,, 100°—19·5 l. [0·698 c.ft.] up to 100°	1472
11	,, ,, 100° ,, 125°— 9·5 l. [0·335 ,,]	1742
12	,, ,, 125° ,, 150°— 2·1 l. [0·074 ,,]	2023
13	,, ,, 150° ,, 175°—0·08 l. [0·003 ,,]	2237
14	,, ,, 175° ,, 200°— 0·9 l. [0·032 ,,]	2237
15	,, ,, 200° ,, 300°— 1·4 l. [0·049 ,,]	2034

From this it is seen that the carbon did indeed take up quite a considerable quantity of high calorific gases. Whereas the crude gas was 823 B.Th.U. to begin with, after passing through the carbon it immediately lost over 200 B.Th.U. through being deprived of high calorific constituents—that is to say, the higher-molecular hydrocarbons. Its calorific value subsequently gradually increased as the active carbon became saturated. After 350 litres [12·358 c.ft.] of gas had passed the carbon, it was still over 100 B.Th.U. less than the crude gas. On the other hand, the gases retained by the carbon were of correspondingly higher calorific value. When, after the gas stream had been shut off, the pressure was released from the carbon cylinder, the more gas that issued from it, the higher was the calorific value, since, under falling pressure, the lower the pressure fell, the more gas was given up by the carbon. Summarizing the results shown in the table, it may be said that crude coal gas with a calorific value of 823 B.Th.U. under 12 to 20 atm. pressure passed through active carbon, and the first 350 litres [12·358 c.ft.] emerged with calorific value between 613 and 710 B.Th.U. per cubic foot. By removing the pressure from the active carbon, 30 litres [1·059 c.ft.] of gas, of 710 to 1017 B.Th.U., were released from the carbon, and, by heating the latter, a further quantity of 33·5 litres [1·183 c.ft.] of 1017 to 2237 B.Th.U.

Details need not here be given of the results obtained with coke-oven gas. They bear out exactly the same points, though in different degrees—owing, of course, to the different composition of the gas.

FACTORS INFLUENCING THE AMMONIA YIELD IN THE CARBONIZATION OF COAL.

By H. D. GREENWOOD, M.Sc., and H. J. HODSMAN, M.B.E., M.Sc., F.I.C., Department of Coal Gas and Fuel Industries, Leeds University.

[A Paper read before the Yorkshire Section of the Society of Chemical Industry—reproduced from the Society's "Journal."]

(*Concluded from p.* 529.)

DESTRUCTION OF AMMONIA IN COAL GAS.

On substituting coal gas containing oxygen for air, the loss of ammonia was greatly reduced (see Table III., below, and fig. 3, *ante*), and was much less also than the loss in the presence of nitrogen with a similar low concentration of oxygen. These results show that below 800° C., under the conditions obtaining, though the ammonia passes through the apparatus practically unchanged, the whole of the oxygen is removed, presumably by reaction with hydrogen or hydrocarbon constituents of the gas. If the whole of the ammonia lost had been removed by oxidation, it would have consumed only a fraction of the oxygen actually disappearing. Even at 600° C., a temperature at which the oxidation in air and in nitrogen *plus* oxygen was considerable, the whole of the oxygen was removed in the reaction tube, while the ammonia passed through unimpaired. This points to the conclusion that in a coal gas the oxidation of the hydrogen or hydrocarbons takes precedence over that of ammonia, and that if any of the latter is decomposed at all, it must be due rather to a dissociation phenomenon.

TABLE III.

Temp. ° C.	Rate of Flow, Litres per Hour.	P.Ct. NH_3 Entering.	P.Ct. NH_3 Leaving.	P.Ct. NH_3 Loss.	P.Ct O_2 in Gases Entering.	P.Ct. O_2 in Gases Leaving.
625	4·600	1·340	1·340	*Nil*	1·08	*Nil*
725	4·595	1·445	1·380	4·5	1·08	*Nil*
775	4·21	1·400	1·291	8·0	1·07	*Nil*

TABLE IV.

Temp. ° C.	Rate of Flow, Litres, Per Hour.	P.Ct. NH_3 Entering.	P.Ct. NH_3 Leaving.	P Ct. NH_3 Oxidized.	Total Volume of Air + NH_3 Passed over Firebrick.	Remarks.
635	3·71	1·591	0·148	96·4	6·7	Gases saturated at 24° C. to 30° C.
640	3 65	1·664	0·643	61·5	20·0	
640	3·70	1·709	1·164	32·0	67·3	
640	3·63	1·630	1·233	24·4	93·0	
665	3·70	1·770	1·271	28·8	103	

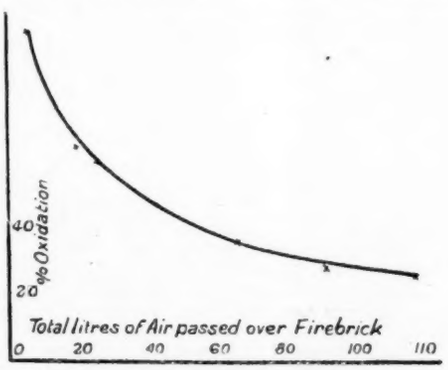


Fig. 4.—Loss of Activity of Firebrick.

Oxidation in Contact with Firebrick.

As contact material, the silica was replaced by fragments of unused fireclay brick, which is porous and contains iron or other oxides which display marked catalytic activity towards these reactions. Firebrick from the Leeds district containing 1·4 p.ct. of ferric oxide was used.

Though the material at first displayed marked activity, this was found, on repeating experiments at any one temperature, to fall-off rapidly. The results in Table IV. (fig. 4) clearly show this decrease in activity. Other samples of firebrick from the same source gave almost identical results! Further, the oxidation fell-off at the same rate with mixtures of ammonia with either air or coal gas.

The passage of dry air alone had a similar effect, which cannot, therefore, be attributed to any reactions involved in the actual oxidation of the ammonia. The cause of this decay of the catalyst remains unexplained. The results obtained when the firebrick had attained a stable condition are collected in Table V., and for the purposes of comparison have been plotted (fig. 4), along with the figures obtained with fused silica.

TABLE V.

Temp. ° C.	Rate of Flow, Litres per Hour.	P.Ct. NH_3 Entering.	P.Ct. NH_3 Leaving.	P.Ct. NH_3 Oxidized.	Temp. of Saturation.	P.Ct. H_2O in Gases.	Remarks.
450	3·65	1·620	1·570	3·1	23° C.	2·8	
540	3 69	1·659	1·545	6·8	23° C.	2·8	—
540	3·71	1·805	1·632	9·5	Dry	*Nil*	—
640	3·66	1·801	1·370	23·9	23° C.	2·8	A small percentage of NH_3 was oxidized to NO, usually about 2·5 p.ct. of the total NH_3 oxidized.
640	3 67	1·753	1·181	32·7	Dry	*Nil*	
740	3·70	1·732	0·827	52·3	23° C.	2·8	
740	3·59	1·613	0·568	64·9	Dry	*Nil*	
785	3·50	1·802	0·100	94·5	Dry	*Nil*	
			Influence of rate of flow.				
740	4·90	1·356	0·682	50·0	Dry	*Nil*	—
740	3·59	1·613	0·568	64 9	Dry	*Nil*	—
740	3·00	1·976	0·395	80·0	Dry	*Nil*	—

TABLE VI.

Temp. ° C.	Rate of Flow, Litres per Hour.	P.Ct. NH_3 Entering	P.Ct. NH_3 Leaving	P.Ct. NH_3 Loss.	Sat. Temp. ° C.	P.Ct. H_2O in Gases.	P.Ct. O_2 Entering.	P.Ct. O_2 Leaving.
600	3·87	1·509	1·508	*Nil*	23	2·8	2·1	0·1
680	4·35	1·399	1·360	2·9	23	2·8	0 85	*Nil*
780	4·41	1·202	1·098	8·7	26·5	3·45	0·98	*Nil*
775	3·63	1·476	1 353	8·3	26·5	3·45	2·1	*Nil*
780	3·62	2·010	1·810	9 7	dry	—	2·2	*Nil*

Destruction of Ammonia in Coal-Gas Mixtures.

The loss of ammonia in the presence of stabilized firebrick was similar to that observed in the presence of silica, and, as before, the products were practically free from oxygen after contact. Contact material in its originally more active condition caused a considerably greater decomposition. An increase in the percentage of oxygen from 1 to 2 p.ct. had no appreciable effect on the rate of decomposition of ammonia. Here, again, at 600° C. the oxygen is taken-up by some constituent of the coal gas, while the ammonia remains intact, as in the experiments of Table III. There are, then, no grounds for ascribing any loss of ammonia in a coal gas under the conditions of these experiments to oxidation at all. If this is correct, then Sommer's conclusions are unsound, and experiments on mixtures of air and ammonia are irrelevant to the phenomenon in coal distillation.

Influence of Water Vapour on the Oxidation in Air.

The experimental figures are given, along with those for the dry gases, in the various tables to which reference has already been made.

When mixtures of ammonia and air were heated in contact with silica (Table I.), the influence of moisture was negligible at the lower temperatures, and a reduction of 2·5 p.ct. only was observed in the oxidation at 700° C. In coal gas (Table VI.) no appreciable difference was observed in the experiments made.

In the presence of the firebrick already mentioned, the oxidation in a mixture of ammonia and air was materially influenced by the presence of moisture—*e.g.*, 2·8 p.ct. of water vapour caused a decrease in the percentage oxidation from 64 to 52·3 p.ct. at 740° C. (see Table V. and fig. 3).

In view of these results, the experiments were extended to higher percentages of moisture (Table VII.), but the difficulty of preventing condensation limited the saturation temperature—65° C., corresponding to 25 p.ct. (H_2O). The greater stability of the ammonia observed in the presence of water vapour may be attributed, generally speaking, to two factors—viz., the increased rate of flow with consequent shortened time of contact, and some specific action (chemical or physical) of the water vapour.

Curve A (fig. 5) shows the influence on the degree of oxidation at 740° C. of the rate of flow alone in the dry mixture of ammonia and air. In curve C the percentage oxidation is plotted against rate of flow when the gas mixture contains water vapour in proportion depending on the temperature of saturation employed. The percentage of water vapour is also indicated. By subtracting curve A from curve C, we are left with curve B, which may be regarded as showing the specific effect due to the water vapour. This "specific influence" of the water vapour increased with the water content at first; but when 12 p.ct. was reached, the observed effect can be accounted for by the smaller time of contact due to increasing percentages of moisture.

These results, then, confirm qualitatively Sommer's experiments at lower temperatures, although no such powerful influence as recorded by him has been observed. Thus, at 450° C., his loss of ammonia by oxidation fell from 12 to 2 p.ct. with the addition of 2·3 p.ct. of water vapour.

In mixtures of coal gas and ammonia up to 800° C., the moisture appeared to have no appreciable effect; but the total amount

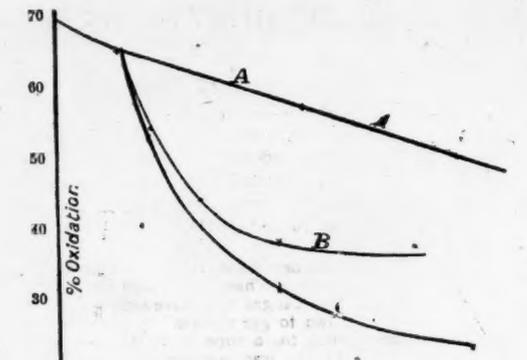


Fig. 8.—Influence of Moisture on Oxidation of Ammonia.

TABLE VII.

Temp. °C.	Rate of Flow, Litres per Hour.	P.Ct. NH_3 Entering.	P.Ct. NH_3 Leaving.	P.Ct. NH_3 Oxidized.	Sat. Temp. ° C.	P.Ct. H_2O.	Rate of Flow of Air + Water Vapour per Hour.
740	3·72	1·613	0·568	64·9	Dry	*Nil*	3·72
740	3·70	1·732	0·827	52·3	23	2·8	3·82
740	3·76	1·936	1·348	30·4	50	12·3	4·28
740	3·70	1·930	1·470	23·6	65	25·0	4·93

of ammonia decomposed is small, and at higher temperatures the results might differ.

From a general survey of these results, as regards mixtures of air and ammonia, we see that a marked preservative effect of moisture only occurred in the presence of substances displaying a considerable catalytic power. The activity of the catalyst is only partially impaired by the moisture, since the oxidation in presence of firebrick and 15 p.ct. of moisture is considerably greater than with silica in the absence of moisture.

It is common knowledge that the presence of moisture is important in many reactions, but its effect is usually accelerative, and the inhibiting action observed here, and by Sommer, is difficult to explain. As just shown, it is greater than can be accounted for by mere dilution, and consequent increase in rate of flow. Moreover, the effect is more intense with the first additions of moisture, which have a small influence on the rate of flow. Nor can it be ascribed to an accumulation of the reaction product on the basis of the law of mass action, for the reaction, as indicated at the outset, is in no appreciable degree reversible.

The observation that the influence of moisture was not marked when the relatively inert fused silica was used as contact material, suggests that in some way the catalyst is involved. The most helpful conception has been obtained from Langmuir's theory of the unimolecular film at the catalyst surface. If we suppose that the oxidation occurs between ammonia and oxygen, possibly atomic, adhering to the contact mass, but not covering it entirely, we can see that the introduction of any other gas or vapour capable of sticking to the surface, and therefore restricting mutual access of oxygen and ammonia, will have a preservative effect towards the latter. Any gas or vapour prone to adhere to the catalyst would have the same effect which might be caused if the proportion present were only small. The available catalyst area once tenanted by water molecules, the addition of further water vapour would apparently have no influence. There is a difficulty, however, as it would appear that the water vapour resulting from the oxidation of ammonia in dried gases should also have this "blanketing" effect.

It is also necessary to reconcile the apparent importance of water vapour here with its unimportance in the commercial oxidation of ammonia. This may, however, possibly account for the apparent paradox just mentioned. In the experiments chronicled here, in dry mixtures of air and ammonia the proportion of ammonia was low (1 to 2 p.ct.), and as this was only partially oxidized, the proportion of water vapour in the product was also small, and added water vapour might make itself appreciably felt. In commercial oxidation 10 to 15 p.ct. of ammonia is employed and completely oxidized, yielding a corresponding proportion of water vapour large enough to render unimportant the presence or absence of water vapour in the air employed.

CONCLUSIONS.

The destruction of ammonia at low partial pressures and in atmospheres of air, of nitrogen containing 1 to 2 p.ct. of oxygen, and of coal gas containing oxygen, at temperatures up to 800° C., both in presence of fused silica and unused fireclay brick, has been examined.

The oxidation of ammonia in air and in contact with the fireclay brick under the conditions of the experiments is distinctly retarded by water vapour present even in small proportions.

In coal gas containing oxygen, the destruction of ammonia is much less marked at corresponding temperatures than with air; and this destruction, owing to the preferential union of the oxygen with the hydrogen, &c., present in the coal gas, is due, not to oxidation, but to a process of dissociation. In these experiments no marked influence of water vapour was observed.

It is doubtful whether direct oxidation of ammonia occurs to an appreciable extent during carbonization, even when oxygen is present. The known deleterious effect of air indrawn during carbonization and gasification is, then, presumably due to the local overheating of the gas following upon the union of the oxygen with combustible constituents. The rise in temperature then facilitates dissociation. It remains to be proved that a preservative effect can be ascribed to the large volume of water vapour in coke-oven gas—*i.e.*, as distinct from that due to dilution and shortened time of contact of the ammonia.

The experimental work on this subject is being amplified, and will be the subject of a further communication.

Discussion.

Prof. J. W. COBB said that he had seen this work in progress, and appreciated the way in which experimental difficulties had been overcome. If air was drawn or forced into a gas-retort, coke-oven, or gas-producer, at the wrong point, it undoubtedly lowered the ammonia yield. Presumably from this work this loss was not due to direct oxidation of the ammonia, but resulted from local combustion of the gas and a dissociation of ammonia, intensified by rise of temperature and catalytic action along the solid surfaces of brickwork or coke.

Mr. W. M'D. MACKEY remarked that the introduction of steam or water vapour into the bye-product coke-oven had often been advocated; but the difficulty was that the steam would intervene between the walls of the oven and the mass of coal in course of coking, and prevent the passage of heat from the flues to the coal.

Mr. AUTY pointed out that the effect of water vapour was rather similar to that of charcoal on phosgene. If the charcoal used and the mixture of phosgene and air were dry, hydrochloric acid was produced; but if the charcoal contained 5 p.ct. of moisture, the phosgene was absorbed without the formation of hydrochloric acid.

Mr. HODSMAN, replying to an inquiry as to the effect of carbonizing in iron retorts on the yield of ammonia, said that the temperatures attained in such apparatus were much below those of current practice, and in consequence no just comparison was possible. Referring to Mr. Mackey's remarks on the effect of water vapour, he did not wish to imply that water vapour was without benefit to the yield of ammonia. On the contrary, he believed that it did operate favourably, but thought caution desirable when accounting for this effect. The conditions in practice were complex, and even under the simplified conditions of laboratory experiment the expected result was often not attained. The reactions of ammonia were very sensitive to catalysts and to temperature under the conditions of practice.

Society of British Gas Industries.—The Society will hold their autumn meeting at the Holborn Restaurant, W.C., on Thursday, Oct. 26, under the presidency of the Rt. Hon. Lord Riddell. The Chairman of the Council (Mr. Albert Cliff, J.P.) will give a short account of the work of the Society during the past six months, and there will be an address by Mr. Arthur Kitson (to be discussed) on "Our System of Finance—the Cause of Unemployment." The business meeting will be preceded by luncheon.

Eastern Counties Gas Managers' Association.—It has been found necessary to postpone the autumn meeting of the Association, which will be held at Norwich on Oct. 19, instead of the 28th inst., as previously arranged. The proceedings will commence at 11 a.m. with an inspection of the gas-works, Bishop's Bridge, where very important and extensive alterations have recently been made. Members will afterwards be entertained at luncheon on the invitation of the Chairman and Directors of the British Gas Light Company. The business meeting will be held in the afternoon, when Mr. Thomas Glover will give a lecture on "Gas-Works Reconstructions at Norwich," illustrated by drawings and lantern slides. This should prove to be a very interesting and enjoyable meeting; and members are requested to note the altered date.

Institution of Chemical Engineers.—At the twelfth meeting of the Provisional Committee of the Institution—Sir Arthur Duckham, K.C.B., M.Inst.C.E., presiding—it was reported that the registration by the Board of Trade was still delayed. Suggestions of the Institute of Chemistry were agreed to, that the definition of chemical engineering should be omitted, and that a clause should be inserted by which the Institution claim no right to prescribe courses of study or to hold examinations whereby qualifications or authority to practise or to use any distinctive title can, or may, be conferred in respect of the practice as such of analytical or technical chemists (other than chemical engineers) or of teachers of chemistry. The Committee were unanimously opposed to changing the title of the Institution. The Hon. Secretary reported that over a hundred completed application forms for membership had already been received. It was agreed that the question of membership must be held in abeyance until negotiations were completed by the Board of Trade.

Will.—Mr. John F. Wells, lately of Cairo, and formerly of High Holborn, a mining and industrial engineer, and said to be the inventor of the first portable producer-gas engine for motor lorries, who died on July 5, left £9509. The testator gives one-fourth of the residue of his estate to Paul Henry Mangin, "requesting him to devote the whole thereof in the development of mechanical traction with gas producers using charcoal or vegetable fuel."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Smokeless City.

SIR,—The authors of the pamphlet recently issued under the above title lay very proper emphasis on the importance of eliminating smoke from the domestic fire, pointing out that the first step on the road to success is to realize that the house chimney is a much more dangerous enemy than the factory chimney (p. 3). They go on to state (p. 66): "There is only one way in which a complete solution of the domestic smoke problem might be attained in reasonable time: by the discovery of a smokeless solid fuel to replace coal. . . . If such a fuel, that would burn cheerfully and well, and would be no more expensive than coal, were available in adequate quantity and at a reasonable price, it would clearly be possible—it would, in fact, be the obvious duty of Parliament in the general interest—to prohibit the burning of raw coal in houses."

It cannot be too strongly emphasized that a fuel such as is described is already available in large quantities and at a reasonable price—the ordinary gas-coke produced as a bye-product from every gas-works in the land. All that is necessary is that the coke should be sized and graded, *and that the fireplace should be correctly designed for this purpose.* The authors of the "Smokeless City" remind their readers (p. 9) that we have much to learn from the foreign practice in heating houses, adding that the manufacturer of gas-stoves or of coal-grates does not consider it his business to know anything about so foreign an apparatus as the continental stove. Yet the Scandinavian countries, without coal of their own, and suffering from a more rigorous winter than ourselves, have been for generations in the habit of importing gas-coke from our North Sea Ports and London.

Recently I have had installed an "open fire coke-stove," of Scandinavian design, and have demonstrated conclusively that gas-coke can take the place of anthracite or any other fuel for heating purposes in the domestic fire. The coke is readily lit, and the fire throws out an intense heat, requiring no attention for hours at a time. It is also most economical in fuel. The matter is of considerable importance to gas-works managers and directors of gas companies, who, it is suggested, might pay more attention to the proper grading of their coke, and investigate the possibilities of suitably designed stoves and grates for burning their solid fuel.

ROBERT STANDEN,
Lt.-Colonel.

15, *Pall Mall East, S.W., Sept.* 7, 1922.

Production Efficiency by Injecting Oil on to Incandescent Coke.

SIR,—Will you permit me to reply to one of the remarks made in the editorial notes of last week's issue of the "JOURNAL," on the paper read by me in Paris, at the last annual meeting of the Société Technique du Gaz, on the Rincker processes of complete gasification and carburation? The remark I refer to is that the enrichment process appeared crude, and that in your opinion the efficiency, using oil, could not be high.

I quite agree that the mere injecting of oil, as it is sometimes done, on to incandescent coke at anything but a suitable temperature for carburetting, is a crude process which shows a very poor efficiency. But it was one of the objects of my paper to show that when temperatures and gas velocities are properly regulated, as is possible with the Rincker C.W.G. plant, the efficiency of carburation on a column of coke compares very favourably with that obtained in the ordinary C.W.G. apparatus.

In the tables which are alluded to in the extract of my paper published in the "JOURNAL," I gave the full data of tests, extending over a considerable time, carried out on a Rincker C.W.G. plant under the able supervision of Dr. Ruys. These tests show that with an ordinary gas-oil the normal working efficiency can be taken to be about 75 p.ct., and that under special conditions much higher figures even have been obtained. With heavier oils the efficiency is necessarily lower; but with a good fuel-oil it is still very satisfactory (68 to 70 p.ct.).

When it is reckoned that the price of fuel-oil is about 60s. a ton less than that of gas-oil (according to present prices in France), it is manifest that the Rincker process, with its possibility of using the former as carburant with excellent results, has undeniable advantages over the ordinary processes.

PAUL GREGORY.

39, *Rue la Boetie, Paris, Sept.* 4, 1922.

Successful Debenture Issue at Chester.—The Chester United Gas Company last week invited subscriptions to an issue of £41,890 of 5 p.ct. redeemable debenture stock, at the price of £97 10s. p.ct. The stock is redeemable on Dec. 31, 1942, or at the option of the Company after Dec. 31, 1932, or any time thereafter after giving six months' previous notice. The list was opened on Sept. 4; and the issue was fully subscribed and the list closed on the following morning.

Gas Exhibition at Derby.—An exhibition in connection with the Derby Gas Light and Coke Company has been held in the Drill Hall, where numerous appliances for domestic and factory use have been on view, and have been inspected by large numbers of people. The value of gas for lighting and heating purposes has been thoroughly explained and demonstrated by experts. The exhibition has also given the officials an opportunity of removing any wrong impression that might have existed in the minds of consumers regarding the therm system. There are in use in Derby at the present time over 30,000 gas-cookers; and this branch of the business occupied an important position in the exhibition, with the most gratifying results. The system of automatically controlling gas has been made clear; and Radiation Ltd. have keenly interested visitors in their specialities.

MISCELLANEOUS NEWS.

KING'S AWARD FOR BRAVERY.

For their bravery in attempting to rescue two fellow workmen who were suffocated by sulphuretted hydrogen at the bottom of a large still, the King has awarded the Edward Medal to William King and Thomas Atkinson Whitehead, two employees of Messrs. Brotherton and Co., Ltd., of South Dock, Sunderland.

While one of the stills, which are 10 ft. in diameter and 20 ft. deep, was standing empty, a workman descended it by a rope ladder through the small manhole in the cover. When he reached the bottom, he collapsed. His mate, realizing that gas must have accumulated in the still, shouted for help, and ran to get a rope. A workman named George Rogers, without waiting for a rope, immediately went down the still to the rescue, but he also was overcome. William King at once entered the still with a handkerchief round his mouth and a rope attached to his body. He was overcome, and had to be pulled out. Thereupon Whitehead made two attempts to reach the men, first equipped with a gauze respirator, and then with a hood with oxygen pumped into it; but on both occasions he had to be pulled out. King then made a further attempt, wearing a respirator, and having a safety-belt round his body. By this time other workmen had removed the pitch-pipe from the bottom of the still and began to force air in, and King was able to attach ropes to the bodies, and they were drawn out. Artificial respiration was tried, but the men were found to be dead. The danger due to sulphuretted hydrogen accumulating in the still was well known to King and Whitehead.

SOUTH METROPOLITAN CO-PARTNERSHIP FESTIVAL.

There was a heartily welcomed return to an old-time custom at the Crystal Palace last Saturday by the South Metropolitan Gas Company, in the holding of a co-partnership festival. A long series of happy gatherings of this character was broken by the war; but this year a revival was decided upon, and on an even more ambitious scale than formerly. It was a real co-partnership festival. That is to say, everyone worked with the utmost will to make it a success, and therefore a success it was. Everything had been well thought out, and in the one thing that had to be left to chance—the weather—the co-partners were also fortunate.

In pre-war years there was a co-partnership dinner, to which, of course, considerations of space made it impossible to invite more than a comparatively small proportion of the total number of co-partners and their wives; but this year all were able to take some part in a celebration that should do something substantial to foster that good feeling which must be the bed-rock of all successful co-partnership. Again, on the present occasion there was a dinner, the 650 seats at which were balloted for among the whole of the co-partners; but this was only one part of the festival. In addition, a programme of sports had been arranged, starting at 11.30 with a cricket match, and concluding with the distribution of prizes and dancing in the Australia ball-room. The Organizing Secretary of the sports was Mr. A. Coleman, and he succeeded in fixing up a list of events of the greatest diversity, which were keenly contested by the many competitors. There was a five miles road race from the Company's offices in Old Kent Road to the Palace, finishing on the track, and in the boating lake there were diving competitions, a water polo match, swimming races, and other attractions. On the sports ground there were races of all kinds, for competitors of different ages and both sexes—including one for co-partners' wives. One item was an excellent exhibition of Swedish drill and Old English dancing, under the direction of Mr. Coleman. The officials (under the leadership of the Co-Partnership Secretary, Mr. W. A. S. Theobald) performed their tasks well, for there was not a hitch to be found in the due carrying out of the programme, the enjoyment of which was much enhanced by the music of the South Metropolitan Gas Company's Military Band, under the conductorship of Mr. Sydney Herbert.

The open air sports satisfactorily brought to a conclusion, there was a move to the theatre. Here more than an hour was pleasantly spent in watching exhibitions of boxing, wrestling, and self-defence. In the exhibition of self-defence, Miss Ethel England gave a demonstration of throws, locks, and holds, based upon the Japanese form of wrestling known as Ju-Jitsu, which she successfully practised upon Mr. Coleman, who impersonated a hooligan. It was a pretty display, and afterwards the audience had the pleasure of witnessing the handing to Miss England of a handsome bouquet of flowers. One must not omit to mention that during the entertainment in the theatre selections were played by the Co-Partnership Orchestra.

THE ESSENCE OF CO-PARTNERSHIP.

The chair at the dinner was occupied by Dr. Charles Carpenter (the President of the Company), who was supported by Mr. Frank H. Jones (Vice-President), Mr. Frank Bush (Director), Mr. P. Richbell, Mr. W. Beard, and Mr. T Roberts (Employee Directors), Mr. Frederick M'Leod (General Manager), and other officers. Well chosen music was well rendered by the "Metrogas" Band. The Loyal Toast having been honoured,

Dr. CHARLES CARPENTER said there was one other toast which it was his privilege to propose, and that was "Prosperity to our Co-Partnership." Some of those present would not need to be reminded that this co-partnership was founded by his predecessor close upon 33 years ago, and therefore had had a life of practically a third of a century. Like many other proposals—and proposals all for the good of humanity—it met in its early days with a great deal of opposition of an extremely aggressive and personal character. But Sir George Livesey was not the type of man to be borne down or shaken from his purpose by difficulties of this kind, and under his care co-partnership not only grew,

but flourished exceedingly. In these 33 years it had lived down some of the opposition that it had had to encounter; but he was afraid that even to-day there was a good deal of feeling against its principles, though this feeling showed itself more in the way of passive resistance than of active opposition. The object Sir George Livesey had in view was the seemingly—to many persons at any rate—impossible one of reconciling the interests of capital and labour. He (Dr. Carpenter) was there that day as the representative of that much-abused class the capitalists. He was addressing them as a capitalist, on behalf of those 13,000 or 14,000 other capitalists whose money had enabled the building-up of the great and useful organization which they knew as the South Metropolitan Gas Company. Sir George's idea was to reconcile those seemingly opposing interests of capital and labour; and those who had been longest in the service of the undertaking, and who had had the greatest experience of co-partnership, would, he thought he might say, without a single exception, be the very ones to testify to the completeness of his efforts. The former practice in connection with this annual festival, which had now for the first time been re-constituted since the war, was to invite a certain number—the number was limited by the holding capacity of the room—of co-partners who had been for a certain number of years in the Company's service, and had during that time accumulated a certain amount of stock. The idea this year, however, had been to arrange the festival on somewhat better lines, and the dinner that day formed only one of the attractions. It was obvious that with many thousands of employees it was impossible to arrange a dinner at which all could be present, so the seats had been balloted for, and it was quite possible there might be present some very young co-partners, as well as some very old ones. For the benefit of the younger members, he would just in a few words describe what was the essence of the scheme. There was nothing of the "ninepence for fourpence" about it. It was not a thing of that kind at all. The framers of the scheme realized that both capital and labour had their duties and their rights, and that both owed allegiance to the public at large, without which it would be impossible for either of them to flourish. Just as standard wages were assured to all employees, so a standard rate of interest was assured to the shareholders. Simultaneously with this was fixed a basic price for gas; and so long as they sold gas at 11d. per therm, so long were the co-partners receiving their standard wages, and the shareholders their standard interest on the money which they had provided. They had now, however, reached the second stage in the operation, by reason of having got down to a lower figure than the basic or standard price. That was to say, they were selling gas to-day at 1d. per therm lower than the 11d. to which he had referred. Of whatever savings might be made, the consumer was entitled to three-quarters, and the other one-quarter was to be divided equally between capital and labour—between the shareholders in the Company and the co-partners. In the current year the Company had, for the first time since the war, a very certain prospect of being able to place something in the bonus books of the employees. It might be asked why they could not have done so before. Well, during the time when the charges for gas were high, there was no justification whatever for asking the consumer to pay more than was sufficient to meet the standard wages. The consumer had his own difficulties, which in very many cases were not less, but probably greater, than those of the co-partners. It must be remembered that the Company had endeavoured to keep pace with the rising cost of living by from time to time increasing wages, while the majority of the consumers were not in so fortunate a position. Now, however, things had begun to move, and he hoped they would move rapidly in the right direction. But co-partnership was more than this. It was a spirit which animated its participators in a way that nothing else, from a business point of view, would be likely to do. It rested with the employees to decide what use they would make of the heritage of co-partnership in which they were the fortunate participators; it rested with them to decide in what way they would increase their holding in the undertaking; and it rested with them to decide how they would strengthen the bonds which bound them to the undertaking and the undertaking to them. He appealed to the co-partners and their wives to do all that was possible to extend the interest they had in the undertaking, so that one day—not in his time, but in the future beyond—they might have the largest share in the undertaking as a whole. ["Hear, hear."] This position was by no means an impossible one, and the co-partners had it in their hands to bring it about. It was a question merely of time on the one hand and of earnestness on the other.

Mr. FRANK H. JONES remarked that he was pleased to have been called upon to say a few words after the toast had been drunk. They ought to feel very proud and very grateful that Sir George Livesey's mantle had fallen upon the shoulders of Dr. Carpenter, because he had not only the ability and the power, but he had also the real earnestness necessary to carry on this co-partnership. He did not know anybody else who could carry on the scheme on the lines laid down by Sir George in the manner that Dr. Carpenter was doing, and he felt sure there must be very few who could do it. He agreed with every word that Dr. Carpenter had said. Long might he be with them to guide them in their co-partnership, and long might this co-partnership flourish. Labour people were clamouring for the control of things. Well, Dr. Carpenter had shown them how, in a very peaceful way, they could gain control of the South Metropolitan Gas Company—not to-day, but in the future. He hoped he might live to see the day.

Mr. FREDERICK M'LEOD said that they had had from the President of the Company a very clear and simple outline of the principles governing their co-partnership. He would like to point out one or two facts which might be of general interest. There were among the Company's employees between 700 and 800 men who had been in the service twenty-five years and upwards; and of this number some forty to fifty had over forty years' service, and one or two approaching fifty years. This indicated pretty clearly that employment with the Company was valued. It was, however, upon their younger colleagues that reliance would have to be placed for carrying forward the standard of co-partnership in the future. A number of those who had borne their share in building-up the prosperity of the Company were reaping their reward to-day in the shape of retirement with pensions which had been very generously bestowed, while the co-partnership had been the means of augmenting what had been obtained by membership of the superannuation fund. But with the advantages that co-partnership gave, they must not forget the obligations to the Company. It should be remembered that, however small and unimportant their daily task, it might be the one thing necessary to secure that complete success which no management could obtain without the loyal co-operation of all. They had a commander on the bridge second to none in the country, and they had men in every department of work who would loyally and zealously carry out every duty imposed upon them. But it was requisite that every individual should recognize his or her share in their job, for it was only in this way that they could expect their co-partnership to continue in its prosperous course. If the spirit that had hitherto been aroused by this co-partnership was handed on to those who would follow the ones now growing old in the service, he had no fear at all for the time that was coming.

Mr. H. CLOUDER (a workmen's representative on the Co-Partnership Committee) said it was a great pleasure to him to propose that the best thanks of that gathering of co-partners be tendered to the President and the Board of Directors for the splendid dinner and for the excellent arrangements that had been made in the grounds for their entertainment later on. It was some years since they had had a gathering of this kind, and in the intervening period the whole world had changed. New men, new methods, and new ideas had arisen; and in some cases these new methods and ideas had engulfed industries in jealousy, discontent, and disaster. This, however, had not been the case with the South Metropolitan Gas Company, and for this there must be a reason. The reason he suggested was that their methods and ideas were founded on the rock of co-partnership. Those who had experienced the benefits of co-partnership, should spread the knowledge of it among their friends. When they were in a good thing, which had proved a blessing to them and their wives and children, it would be very selfish not to pass it on and so help others who were in a less fortunate position.

Mr. E. HEWES (representing the salaried staff on the Committee), in seconding, added his tribute to the scheme. He said he saw no reason to doubt that the younger members would fully recognize the advantages of co-partnership. There could be no question about the benefits it had conferred upon them all, and from the confident tone adopted by the speakers it would seem that the time might not be so very far off when they would be practically the sole proprietors of the concern in which they worked.

The vote of thanks was passed with acclamation, and after the Chairman's acknowledgment the whole party made their way to the grounds, returning later for tea.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" regarding applications to the Board of Trade for Orders under the Gas Regulation Act.

Hayling Island Gas Company, Ltd.

The maximum price now authorized in respect of the supply of gas by the undertakers is 6s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 9d. per therm.

Settle Gas Company, Ltd.

The maximum price now authorized in respect of the supply of gas by the undertakers is 4s. 7d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 16·4d. per therm.

DECLARATIONS OF CALORIFIC POWER.

Edenbridge and District Gas Company.—500 B.Th.U. (Sept. 8.)

Falmouth Gas Company.—500 B.Th.U., in substitution for 460 B.Th.U. (Jan. 1, 1923.)

Good News for Halifax Consumers.—The Halifax Town Council have approved a recommendation of the Gas Committee that the price of gas be reduced 7d. per 1000 c.ft., making it 3s. 11d. Alderman J. H. Waddington pointed out that six months ago the Council reduced the price 6d. per 1000 c.ft. There were 5000 householders who were getting gas for purposes other than lighting at 6d. per 1000 c.ft. below the proposed reduction. Owing to the policy of former Gas Committees and of the Council, enormous capital charges were run up, and £350,000 was contributed to the relief of rates, and so the present Committee could not make further reductions than they were doing now.

Fire at the Portslade Gas-Works.—Early last Sunday afternoon, the driver in No. 1 engine-house at the Portslade works of the Brighton and Hove General Gas Company noticed a strong smell of gas coming from one of the clean gas exhausters. He was approaching it to ascertain the cause, when the gas ignited from the jet photometer, and there was an explosion which blew out the windows. The flame immediately ignited the very dry timber work of the ceiling and roof. The engineman was blown through one of the doors, but fortunately was not seriously injured, only suffering from shock. Mr. Packer, the chief officer of the works fire brigade, happened to be outside the works at the time, and immediately connected a fire hose to the nearest hydrant, and summoned the works brigade to assemble. By that time the fire had got thorough hold of the ceiling, and the roof and the whole of this part of the building was ultimately burnt out. The firemen's efforts were directed to keeping the flames away from the adjacent scrubber-house and boiler-house, and in this they were quite successful. After two hours' work, the flames were subdued; but it took another hour to extinguish the debris which had fallen. In this latter operation the works brigade were assisted by the Hove Fire Brigade, who had been requested to stand by in case of emergency; but the whole of the work of coping with the outbreak fell on the works brigade. Very little damage was done to the machinery, and there was no cessation of gas manufacture. It was possible to change the stream from No. 1 section to Nos. 2 and 3 sections without much loss of gas.

HARROW AND STANMORE GAS COMPANY.

An Increased Sale of Gas.

The Ordinary Half-Yearly Meeting of the Company was held on Monday of last week, at No. 5, Great Winchester Street, E.C.—Mr. A. F. PHILLIPS (the Chairman) presiding.

The ENGINEER AND SECRETARY (Mr. Charles Chambers) read the notice convening the meeting, and the report of the Directors and the statement of accounts for the six months ended June 30 were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said that the results of the half year were satisfactory, as was indicated by the accounts of which he had to ask the approval of the proprietors. The sale of gas showed an increase of 4·84 p.ct. over that of the corresponding half of the previous year, which was evidence of the development of the district that the Company had to supply. In the preceding year, the Company had to contend with the coal strike, which added to the cost, in consequence of having to buy imported coal. There was therefore on the present occasion a considerable saving in the total cost of coal, from which the revenue has obtained the increased profit. The expenditure on capital account for mains, meters, and stoves was £3241; but as £3684 was written-off for depreciation, the capital expenditure really stood at £443 less than on Dec. 31 last. The total capital expenditure was £246,723, which was equal to just under 10s. per 1000 c.ft. of gas sold. This might be considered highly satisfactory. The total sale of gas for the half year was 255 million c.ft. From the revenue account, it would be seen that coal, oil, and coke for producing gas cost £34,820, against £39,164 in the previous year. Carbonizing wages were £1631 less. Repairs of works were £330 more, and repairs of mains and services £1610 more. The other charges were much the same. A sum of £530 had been added to the benefit fund, and £1404 to the special purposes fund. The gas-rental was £64,700, an increase of £1986; but coke and other products only realized £11,987, a decrease of £4191. The balance of revenue was £10,761, an increase of £3055. Favourable contracts had been made for coal, but unfortunately the price realized for products had continued to fall. Adding the £10,761 to the balance brought from last half year and the bank interest, after providing for interest on debenture stocks and income-tax, there was an available balance in profit and loss of £16,276, of which the dividends recommended would require £7340, leaving £8935 to carry forward. As stated in the report, the price of gas was reduced to 13d. per therm from Midsummer last, and the Directors considered the position of the Company would justify them in making a further reduction from Michaelmas next. One penny per therm reduction in the price of the gas meant a saving of £9000 per annum to the consumers. The works and plant had been maintained in an efficient state; but additions to the carbonizing and purifying apparatus required consideration, to meet the increasing output of gas. Larger mains were also needed in some parts of the district, to cope with the developments which were taking place. The Directors had every reason to look forward with confidence to the Company's future. The district supplied was developing rapidly, and the railway communication was excellent.

The VICE-CHAIRMAN (Dr. J. W. Lee Glaisher) seconded the motion, which was unanimously carried without discussion.

On the proposition of the CHAIRMAN, seconded by Mr. A. M. PADDON, dividends were declared for the half year at the rates per annum of 6 p.ct. on the ordinary stock and 5 p.ct. on the preference stock—both less income-tax of 5s. 6d. in the pound.

Mr. R. H. HARRIS inquired whether this was the full statutory dividend.

The CHAIRMAN said they could pay a little more, but it was not considered advisable to do so just now.

Extraordinary General Meeting.

An Extraordinary General Meeting of the Company followed, for the purpose of submitting to the proprietors for their approval the draft of a Special Order under section 10 of the Gas Regulation Act for which application has been made to the Board of Trade.

The CHAIRMAN, who moved that the Draft of the Order be approved, "subject to such alterations as the Board of Trade or Parliament may make therein and the Directors may approve," explained briefly its purpose. He said that under the provisions of the Order the Company would be authorized to issue preference capital at a rate of interest not exceeding 7 p.ct., to borrow money on mortgage or by creation of debenture stock not exceeding one-half of the nominal amount of capital issued, to create and issue redeemable stock, and to arrange for one general meeting a year at such time as the Directors might consider advisable without any obligation to hold half-yearly meetings. The Directors would be empowered to elect an officer to the position of Director, to appoint one of their body as Managing-Director and to fix a remuneration, and to determine the remuneration of the Auditors. There were provisions as to the cutting-off of supplies, and for protection of the gas where high-pressure air was used. Power was given to the Directors to declare interim dividends, to make donations to hospitals, and to grant pensions to the Company's officers and servants. There were also provisions to enable the Company to erect, maintain, extend, alter, and improve the gas-works, with all necessary machinery for the manufacture and supply of gas, on land scheduled, and there were other general provisions for carrying out all these proposals and to effect the necessary modification in the Company's existing Act.

Mr. PADDON seconded the resolution.

Mr. HARRIS asked whether the powers sought were different from those included in other Orders.

The CHAIRMAN replied that the conditions were similar to those sought by other gas companies.

The Order was then approved.

GAS BILLS AND THE THERM.

The CHAIRMAN said it was now his pleasure to propose a hearty vote of thanks to the officers and employees for their services during the past half year. The accounts which had just been submitted showed that these services had been well performed, and he believed that throughout the district everyone was satisfied with the supply of gas. No doubt consumers would like it a little cheaper; but they must bide their time, and this would come about.

Mr. W. G. BEAUMONT seconded the vote, which was cordially passed, and was acknowledged by Mr. CHAMBERS.

Mr. E. L. BURTON, proposing a similar vote to the Chairman and other members of the Board, declared that they were extremely fortunate to have Mr. Phillips to preside over the Company, and they were equally fortunate in having as Directors those gentlemen who were seated with him at the table. The fact that the Company stood so well, and that the dividend was being maintained, showed that their affairs were ably administered. Gas undertakings had no greater trouble now than the newspaper campaign on the question of therms and high gas bills. It was a little unfortunate that the newspapers should have acted as they had, but he believed it was done in sheer ignorance. Really nothing could be more nonsensical than to take one quarter's gas bill alone and compare it with another. In the first place, the corresponding (June) quarter of 1921 was characterized by the catastrophic coal strike, when most people tried their best to conserve the coal and gas supplies, by using as little as possible. This disability did not recur in the quarter to last June, and so they made full use of a comparatively cheap gas supply. For his own offices the bill for gas supplied by the Gas Light and Coke Company was just double what it was a year ago; but he had used a gas-stove during the early part of last quarter, whereas in 1921 he sat without one. The increased rental of the Harrow Gas Company for the June half year, 1922, as compared with the same half of 1921—no therms being utilized in the first period, but wholly in the latter period—was just about 3 p.ct.; and he thought the same thing would more or less apply to other undertakings that were being so abused.

Mr. S. SPENCER, who seconded, agreed that the newspaper agitation arose from sheer ignorance.

The CHAIRMAN, in acknowledgment, said the Board appreciated the vote. He believed they had done their very best to look after the consumers' interests, and at the same time to protect those of the proprietors. In his own case, his gas account for the June quarter was 75 p.ct. more than for the corresponding quarter of last year, but there was a distinct reason for it, for the cook was instructed to do everything by gas, and not to use the kitchen fire at all. Taking haphazard from the rental book of one company with which he was connected the accounts of 164 consumers for the past quarter, he found that 82 showed an increase and 69 a decrease, while 13 were the same as in the corresponding quarter of last year. The total increase in the rental amounted to only 4 p.ct. This referred to a works close to London, and showed that the remarks of the newspapers had been made under a misapprehension. They did not quite understand the facts. He did not think for a moment that the newspapers wished to mislead the consumers; they only desired thoroughly to thresh out the question.

HASTINGS AND ST. LEONARDS GAS COMPANY.

Half-Yearly Meeting.

With the report which was adopted at last week's meeting of the Company, the Directors submitted accounts for the six months ended June 30—the first period under the thermal standard. It would, the Directors said, be seen that the accounts were satisfactory, the profit being sufficient to pay the dividends recommended and leave a balance of £493 to be carried forward. The climatic conditions during the half year were favourable to the use of gas appliances. This was the chief cause of an increased sale of 7·54 p.ct; but the larger number of consumers, as judged by the meters fixed and appliances supplied, also contributed to the result. Favourable coal contracts had been entered into (at about 75 to 80 p.ct. above pre-war prices), but as against this the market for residuals was still very depressed, and would adversely affect the revenue account. Notwithstanding some adjustments, the wages paid during the half year amounted to £14,468, as against £6878 in the corresponding period of 1914. This represented an increase of 8d. per 1000 c.ft. With shortened hours of labour, more holidays, and the cost of living at its present level, this item was necessarily higher. Some renewals of mains in the Clive Vale district had been made; and in connection with the extraordinary dinner-hour cooking load—particularly on Sundays—further work of a similar character had to be undertaken. In anticipation of reduced costs in the immediate future, more particularly of raw material, the price of gas was reduced to 1s. 1d. per therm as from the midsummer readings of the meters. This was equal to 4s. 11·8d. per 1000 c.ft., and represented a total reduction of 1s. 3d. per 1000 c.ft. from the maximum war price.

The CHAIRMAN (Dr. G. G. Gray, J.P.) said 15 million c.ft. more gas had been sold in the past half year than in the same period last year. As to the recent agitation in the papers, he believed the thermal unit system would work as well when it was known as did the old method.

The report and accounts were adopted, and dividends were declared at the rates, less income-tax, of £6 11s. 3d. p.ct. per annum on the 5 p.ct. converted stock, £5 1s. 3d. p.ct. per annum on the 3½ p.ct. converted stock, and £6 1s. 11d. p.ct. per annum on the 5 p.ct. additional stock.

A vote of thanks to the Chairman and Directors, the Engineer and General Manager (Mr. C. F. Botley), and the staff concluded the meeting.

Dudley's Opposition to the Therm.—The application of the Dudley Gas Company to the Board of Trade to put into operation the therm system of charging for gas is to be opposed by the Town Council. The Lighting Committee have engaged Mr. Arthur Valon to prepare a report, and have instructed the Corporation's parliamentary agents to deposit with the Board of Trade objections to the application. They also recommend that a protest against any alteration of the existing mode of charging be sent to the Board of Trade.

OXFORD GAS LIGHT AND COKE COMPANY.

The Annual General Meeting of the Company took place at Oxford on Friday, Sept. 1, when Alderman F. W. ANSELL, J.P. (the Chairman), presided.

The CHAIRMAN, in moving the adoption of the report and balance-sheet for the year, mentioned that the items of expenditure were lower than for the previous year, with one or two exceptions. The saving here effected was, however, nearly balanced by the lower return from residual products. The coke market had been badly hit by the recent strikes, tar had been a falling market, and ammonia liquor was valueless up to four months ago, when, he was pleased to say, a slight improvement was shown. He referred to the therm system of charging, and pointed out that the idea entertained in some quarters that this new method was a device of the gas companies to get more out of the public was entirely unfounded. The system—a perfectly fair one—was suggested by an entirely independent body of scientific men, was approved by the Board of Trade and the local authorities concerned in safeguarding the public, and its introduction was being followed by a steady and substantial reduction in cost to the public for equal work done in lighting, cooking, or heating. What so many people forget was that a high price is not only no advantage, but a positive disadvantage, to the owners of gas-works. A rise in price of gas must, by law, be followed immediately by a fall in dividends. The aim of every gas company was, therefore, to bring down the price of gas at the earliest possible moment to the lowest figure at which it could be supplied and the dividends allowed by Statute under the sliding-scale be earned.

Mr. J. PIKE seconded the motion, which was carried unanimously.

The CHAIRMAN proposed, and Mr. PIKE seconded, the payment of a dividend of 5 p.ct. per annum on the preference stock and 8 p.ct. per annum on the ordinary stock for the half year ended June 30, which absorbed £5110, after deduction of income-tax, leaving £12,301 to be carried to the next account. This was agreed to.

The CHAIRMAN proposed, and Mr. PIKE seconded, a vote of thanks to the General Manager and Engineer (Mr. W. E. Caton) and other officers and staff of the Company, together with the employees, for their services during the year.

Mr. CATON, replying, remarked that without the loyal co-operation of every member of the undertaking, comprising some 200, it would be impossible for him to place before the shareholders such a good account of the year's working. He referred to a few matters which did not appear in the balance-sheet, the chief among them being that the make of gas per ton of coal carbonized had maintained the high standard of efficiency set by the previous year. The quality of gas supplied, as tested by the Official Gas Examiner, showed it to have been maintained at approximately 10 B.Th.U. above that required by law. The number of consumers had increased by 255 during the year, and the number of cookers, fires, and water-heaters on hire and sold outright by the Company had increased by 1606. The most important item of news, however, was that from the next reading of the meters the price of gas would be still further reduced by 1d. per therm, or 4·6d. per 1000 c.ft., making, with the reduction that took effect from the June reading of meters, 2·2d. per therm, or just over 10d. per 1000 c.ft. from the price ruling up to June 25. This total reduction in effect meant a saving to the consumers of £22,000 per annum. The new price would be 9d. per therm within the city and 10·2d. per therm without.

The meeting concluded with a vote of thanks to the Chairman and Directors.

THE NITROGEN POSITION IN GERMANY.

The Prospect of Competition for Export.

The following remarks on "The Nitrogen Position in Germany," which appear in the current issue of the "Chemical Trade Journal," arise from the unexpected announcement that the German Government have sanctioned the importation of 200,000 tons of Chilian nitrate into Germany up to May 31, 1923, and that they have also further consented to the free importation of unlimited quantities for consignment after the first 200,000 tons have been disposed of.

Shortly after the outbreak of the war, the Prussian Ministry of Agriculture elaborated a programme according to which the German chemical industry was to produce annually a quantity of nitrogenous products corresponding to 500,000 tons of pure nitrogen. Now, while it is certain that this production figure has not yet been realized, there exists considerable doubt as to the actual output capacity of the industry at the present time. M. Camille Matignon, who recently returned from a prolonged tour in Germany, studied this question closely, and at the recent Congress of Industrial Chemistry at Marseilles gave it as his considered opinion that the beginning of 1923 at the latest would see the complete realization of the original project and the absolute emancipation of Germany from the necessity of importing any nitrogenous fertilizers whatsoever. On the other hand, various authorities are inclined to contest this view, and to place the total German production of nitrogenous products for the present fertilizer year at a figure of not more than 340,000 tons of pure nitrogen. This latter forecast is the one adopted by the Prussian Ministry of Agriculture itself, and was given at a meeting of the Commission for the Study of Fertilizers in June 16 last by Dr. Mickel, the representative of the Ministry. As it is very improbable that this German estimate is anything but a conservative one, it may be taken as indicating the lower limit. For the year ended May 31, 1922, the total German production of nitrogen products, again expressed in terms of pure nitrogen, was 290,000 tons, of which 190,000 tons were furnished by synthetic ammonia, 40,000 tons by cyanamide, and 90,000 tons by the ammonium sulphate from the coke-ovens and gas-works.

Assuming, then, that the total production during the current year will be in the neighbourhood of 340,000 tons of nitrogen, it is instructive to examine some of the consumption figures. In the year 1913 the total consumption of nitrogenous fertilizers by German agriculture was roughly equivalent to 200,000 tons of fixed nitrogen. War-time and post war-time needs for increased home production of foodstuffs have raised this figure to 250,000 tons, or at the outside 270,000 tons; and it would seem at first glance that a production of 340,000 tons of combined nitrogen should fully meet these requirements, even after allowing for the nitrogen products demanded by industry. This is evidently not the case, for Dr. Mickel himself estimated that Germany would need 500,000 tons of Chilian nitrate (equivalent to 80,000 tons of combined nitrogen) before the end of next May. The situation would appear anomalous; Germany requiring over 50 p.ct. of its pre-war imports of Chilian nitrate, and at the same time producing a surplus of nitrogen products. Dr. Mickel ascribes the demand for Chilian nitrate, not to a general shortage of nitrogenous fertilizers, but a special shortage of rapidly assimilable fertilizers, for spring application of which nitrate of soda is the type *par excellence*. According to him, of all the synthetic nitrogen compounds manufactured in Germany, the nitrate-sulphate of ammonia made at Oppau proved the only really satisfactory substitute for Chilian nitrate; and until its manufacture is pronounced safe and resumed, the demand for the South American material will continue to exist. There is always the possibility, of course, that the anticipated output of 340,000 tons of combined nitrogen during the present year will not be realized; but this is only a possibility, the probability being that the minimum production will be reached.

The question arises as to the ultimate fate of the surplus nitrogen products which must thus accumulate in Germany. An export outlet will undoubtedly be sought for them, possibly in the form of ammonium sulphate or similar ammonium compound; and it is not at all unlikely that when the production of ammonium sulphate in this country recovers to the extent that a good surplus for export is available, vigorous competition on the part of Germany will have to be faced.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Sept. 6.]

Nos. 23,240 to 23,878.

ANDREWS, W. F.—"Gas-heated geysers." No. 23,868.
BARKER, F. G.—"Manufacture of combustible gases." No. 23,761.
BEASLEY, C. H.—"Recording gas-calorimeters." No. 23,620.
BELTON, F. W. J.—"Effluent valve for ammonia liquor, &c., plant." No. 23,264.
BROADHEAD, C. F.—See Barker, F. G. No. 23,761.
CARON, F.—"Coin-freed gas-meters." No. 23,611.
COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATÉRIEL D'USINES À GAZ.—"Automatic lighting and extinguishing devices for gas-burners." No. 23,870.
CRACKNELL, T.—"Gas fires, stoves, &c." No. 23,325.
CREASY, H.—"Joint for concrete and cast iron pipes." No. 23,606
DEMPSTER, LTD., R. & J.—See Belton, F. W. J. No. 23,264.
EDWARDS, A. H.—"Gas cooking-apparatus." No. 23,742.
HACKFORD, J. E.—"Manufacture of gas from oil, and utilization of resulting gas." No. 23,572.
HARTRIDGE, O. C.—See Andrews, W. F. No. 23,868.
HUMPHRYS, N. H.—"Gasholders." No. 23,432.
HUNT, P. C. H.—See Barker, F. G. No. 23,761.
KILFORD, F. C.—See Creasy, H. No. 23,606
LAING, B.—"Distillation of carbonaceous, &c., materials." No. 23,796.
MEADE, A.—"Gasification of coal." No. 23,398.
NEATH, E.—"Manufacture of gas from coal and oil." No. 32,869.
NIELSEN, H.—See Laing, B. No. 23,796.
ROSS, A.—"Gas-economizing apparatus." No. 23,463.
SALERNI, E. M.—"Apparatus for purifying gases, &c." No. 23,581.
SALERNI, E. M.—"Cooling coke, &c." No. 23,585.
STEINHEIL, PAUL DE, BARON.—"Inlet gas fuel turbulator." No. 23,723.
WALKER, B. R.—See Cracknell, T. No. 23,325.
WALLACE, E. C.—"Bituminous paving-material, and method of preparing same." No. 23,319.
WATSON, A.—"Pipe-joint." No. 23,440.

Price again Reduced at Swansea.—The Swansea Gas Light Company have announced the second reduction in the price of gas this year. In April last a reduction of 2·6d. per therm took place; and the present reduction of 0·6d. makes the price 14·8d. per therm.

New Companies.—There has been registered as a private company Carboleum (Spain), Ltd., with a capital of £1500, to carry on business as distillers of oil, coal, shale, and carbonaceous substances. Office: 66, Victoria Street, S.W. Another private company is Tarbitumac, Ltd., with a capital of £30,000, asphalters, road tar, and tar macadam makers. The office is at 65, Victoria Street, S.W.

Retford Gas Profit.—The annual report of the Retford gas undertaking shows a net profit on the year's working of £365, against £1390 for the preceding year. The total quantity of gas made was 100,111,000 c.ft., an increase of 9727 c.ft. Altogether 8184 tons of coal were carbonized, against 7738 tons; and the coal strike cost the department £2500, incurred solely through anxiety to serve the public, when the price of gas was not increased.

A Faulty Gas-Pendant.—Evidence given at an inquest at Bath showed that a fatality had been caused through a gas-pendant in a bedroom being faulty, and thus permitting an escape of gas. Mr. and Mrs. Charles Tidman, who arrived on a visit to the city last Saturday week, were the following morning discovered in bed unconscious, and Mr. Tidman subsequently died. A verdict was returned of "Death from syncope from gas inhalation."

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Sept.* 11.

In the London tar products market business is steady. Pitch maintains its firm tone; the price being about 85s. per ton *ex* makers' works. Creosote is in good demand, particularly for export; the price being round about 6¾d. net per gallon in bulk. Benzole is the most interesting of the other tar products; there being a good demand for motor purposes. The prices are unchanged from last quotations.

Tar Products in the Provinces.

Sept. 11.

The average values for gas-works products during last week were: Gas-works coal tar, 51s. to 56s. Pitch, East Coast, 87s. 6d. to 90s. f.o.b. West Coast—Manchester, 77s. 6d. to 78s. 6d.; Liverpool, 78s. 6d. to 79s. 6d.; Clyde, 79s. 6d. to 80s. 6d. Benzole 90 p.ct. North, 2s. to 2s. 1d.; crude 65 p.ct. at 120° C., 1s. 1½d. to 1s. 3d. naked at makers' works; 50-90 p.ct., naked, North, 2s. to 2s. 1d. Toluole, naked, North, 2s. to 2s. 3d. nominal. Coal tar crude naphtha in bulk, North, 8½d. to 9½d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 10d. Heavy naphtha, North, 2s. to 2s. 1d. Creosote, in bulk, North, liquid, 6½d. to 6⅝d.; salty, 5⅝d. to 5¾d. Scotland, 4⅝d. to 5d. Heavy oils, in bulk, North, 6¼d. to 6½d. Carbolic acid, 60 p.ct., 2s. to 2s. 1d. Naphthalene, £12 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 5d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

FROM A MARKET CORRESPONDENT.

Bye-Products Trade.

No material change is to be noted in this market, although pitch seems to be getting steadily stronger. For shipment between January and April next year 87s. 6d. per ton has recently been paid, and French buyers have been in the market at 80s. per ton f.o.b. at an English port. The demand in South Wales still remains heavy, and prices range up to 90s. per ton. In other directions there is a demand for many products from America which should shortly have a decided effect upon prices. Creosote is very firm on this account, and sellers here are taking 6½d. per gallon, although it is possible that even higher prices may be reached before the end of the year. Solvent naphtha, heavy naphtha, and benzoles are without change. The position in carbolic acid has not altered very much; but there have been reports of America's demand for crystals, which are much firmer than recently. Crude carbolic acid 60's is steady. Cresylic acid is firm at 2s. 4d. to 2s. 6d. per gallon. Naphthalenes are quiet, with refined quoted at £17 to £18 per ton. In intermediate products there is much more interest shown, although business remains quiet, with a slight upward tendency in certain directions. Aniline salt is firm on export inquiry; but the trade in aniline oil is mostly on home account. Quotations are 1s. 1d. per lb. in each case. Beta naphthol is quoted at 1s. 5d. per lb., and resorcin remains at 5s. for technical grade, and salicylic acid 1s. per lb. for technical grade.

Sulphate of Ammonia.

There is no material change in this commodity. The export trade remains fairly strong at £18 to £19 per ton, and rather larger quantities are being taken by home consumers—probably in anticipation of higher prices very shortly. Available supplies remain short here, on the Continent, and in the United States. In the last named country, no improvement in the position of supplies can be expected until towards the end of the year—at any rate, until the strikes are out of the way.

Sixpence Off at Leeds.—The Leeds Corporation Gas Committee have reduced the price of gas 6d. per 1000 c.ft.

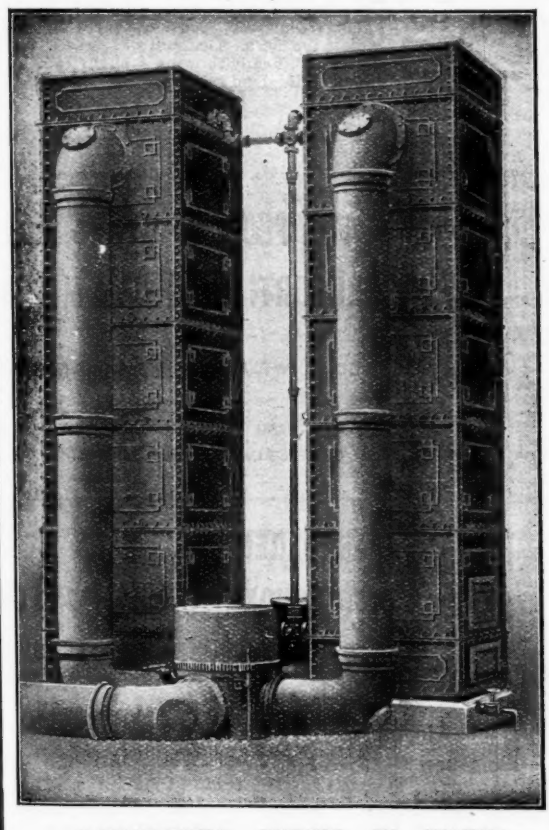
Cheaper Gas at Lytham.—The Lytham Urban Council have approved a recommendation of the Gas Committee that the price of gas be reduced 3d. per 1000 c.ft., as from the September readings, making the charge by ordinary meters 4s. 3d., less 4d. discount.

Another Reduction at Newport (Mon.).—The Newport (Mon.) Gas Company announce a reduction in the price of gas within their area of supply by 1d. per therm (equivalent to 4½d. per 1000 c.ft.) after the September quarter. This is the fourth reduction made within the past twelve months.

Kirkham Gas Company.—A profit of £419 on the last half-year's working is reported by the Kirkham Gas Company. With the sum brought forward there is a balance of £1919. After deducting loan interest, &c., there remains a disposable amount of £1676. A dividend of 6 p.ct. (less income-tax) is recommended.

Further Reduction at Derby.—The Derby Gas Light and Coke Company have decided further to reduce the price of gas by 1d. per therm from the September quarterly reading of the meters. The new price to ordinary consumers for lighting, heating, and cooking purposes will be 9d. per therm, and for motive power and manufacturing 7d. per therm. Both prices are subject to discounts up to 10 p.ct., according to quantity used.

The Therm Explained at St. Austell.—A full explanation of all that the "therm" means has been given by Mr. H. E. Riley, Engineer, Manager, and Secretary of the St. Austell Gas Company, to the members of the local Rotary Club. He said that in his opinion 450 to 500 B.Th.U. was the most serviceable all-round gas supply. In the case of St. Austell, when the change-over to the new system took place, the therm basis would mean an immediate reduction of 6d. per 1000 c.ft. off the present prices. Mr. Riley was accorded a hearty vote of thanks for his informative address.



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STOCK MARKET REPORT.

THE week just completed on the Stock Exchange opened with an improved tone and a little more animation in business, still influenced by the decision of the Reparations Commission; but it did not last long. The hostilities raging in the Near East between Greek and Turk, with all their terrible threats against the peace of Europe, and possibly even other regions, were quite sufficient to cause profound anxiety. Markets in general, with few exceptions, became much depressed; and the gilt-edged department suffered as much as any.

Home Government issues lost their gains of Monday, and closed flat. The big four on Friday marked: Consols 56¾-57⅛, War Loan 99 15/16-100⅛, Funding 86¼-87¼, Victory 88¼-88⅜. Indians and Colonials were down. Home Rails held on as long as they could, and then gave way. Canadians were fairly steady; but Argentines were weak.

The Foreign Market was very variable, fluctuating from day to day. Argentines, Portuguese, Egyptian, and Russian were fairly strong at the close.

Rubber and Oil were better.

Business in the Gas Market showed a further quieting down in point of volume, indicating a very meagre list of undertakings dealt in. More than half of the transactions noted were in Gas Light and Coke and South Metropolitan. The general tone was steady, and changes in quotation were few in number and slight in degree. Gas Light preference rose 1; but the ordinary was ⅛ lower. British debenture was ⅛ lower. In the Continentals, European continued its advance and gained 1¾, and Imperial rose 4½. Cape Town preference advanced ¼.

The following transactions in gas during the week were recorded: On Monday, Bombay 4⅜, 4 13/16. European 10, 10¼, Gas Light ordinary 94½, 94⅜, 94⅞, 95, 95⅛, 95⅛, 95⅜, ditto maximum 62¼, ditto preference 80, 80½, Imperial Continental 146, 148, 148½, Primitiva 14s. 3d., ditto preference 39s. 3d., 40s. 3d., River Plate debenture 55, South Metropolitan 95⅛, 96¼, ditto 6⅛ p.ct. debenture 106, South Suburban 99. On Tuesday, Bournemouth 5 p.ct. 11⅛, Bristol 89⅜, 90¼, European 10⅛, 10⅜, Gas Light ordinary 94⅜, 94⅞, 95, 95⅛, 95⅛, 95⅜, ditto maximum 62⅛, 62¾, 62⅝, ditto preference 81, Imperial Continental 146½, 150, South Metropolitan 95¼, 95½, 96¼, Torquay 7 p.ct. maximum 9, 9⅛, Ottoman 7 p.ct. preference 40s. On Wednesday, Bournemouth 5 p.ct. 11⅛, European 11, Gas Light ordinary 94⅜, 95, 95¼, 95⅛, ditto maximum 63, 63¼, ditto preference 80, 81, Imperial Continental 150, Monte Video 63½, Primitiva preference 40s. 9d., South Metropolitan 95⅛, 95⅞, 96⅛, Barnet "A" 116, 116½, ditto "D" 77, Hornsey 5 p.ct. preference 87½, 88, North Middlesex 5 p.ct. preference 80, Wandsworth 4 p.ct. debenture 75, Woking District 5 p.ct. "C" preference 70, Danish 75s., 78s. 9d., 80s. On Thursday, Commercial 3½ p.ct. 95, 95½, European 11½, 11¾, Gas Light ordinary 94⅜, 94⅜, 95⅛, 95⅜, ditto maximum 62½, 62⅝, Imperial Continental 149, 151, Primitiva 4 p.ct. debenture 70, South Metropolitan 95½, South Suburban 99, Tottenham "B" 98, 99, Barnet "A" 120, ditto "D" 80. On Friday, Bombay 4⅝, 4 16/16. British debenture 75, European 11⅛, 11⅜, 11⅛, Gas Light ordinary 94½, 94⅜, 94⅜, 95⅛, 95½, ditto maximum 62½, 63, Imperial Continental 149, Primitiva 14s. 3d., ditto preference 39s., 40s., 40s. 3d., 40s. 9d., South Metropolitan 96, Hornsey 5 p.ct. preference 90, 90½, Swansea 7 p.ct. preference 104.

In the Money Market, there was a recrudescence of shortage in available supplies, and by mid-week the condition was decidedly tight. Things, however, became somewhat easier before the close. Discount was steady. Silver fluctuated, finally showing a slight fall. The Bank of England rate was 3 p.ct., as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S TRANSACTIONS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Transactions.
£			p.c.					
182,049	Stk.	Aug. 24	4	4%	Aldershot 4 p.c. Pref.	..	70—75*	...
1,551,868	,,	Apl. 12	2½	3 1/8%	Alliance & Dublin Ord.	59—64	62—67	...
374,000	,,	July 13	4	4%	Do. 4 p.c. Deb.	76—79	60—65	...
280,000	5	May 18	7½	4/—	Bombay, Ltd.	5⅛—6⅛	4⅛—5	4⅛—4 13/16
100,000	5	Aug. 10	16	7½%		..	11—12	11⅛—11⅜
383,110	10	,,	7	7%	Bourne-mouth Gas and Water { 5 p.c. B 7 p.c. Pref. 6 p.c. 4 p.c. Deb.	15—15⅛	10½—11⅛	...
115,000	10	,,	6	6%		13⅛—14	8—9	...
162,065	—	June 29	—	4%		..	73—78	...
992,045	Stk.	July 27	14	6⅛/—	Brentford A Consolid.	261—266	93—98	...
734,920	,,	,,	11	6⅛/3	Do. B New	204—209	93—98	...
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	82—87	...
221,400	,,	June 15	4	4%	Do. 4 p.c. Deb.	91—93	75—80	...
214,775	,,	Aug. 24	11	11½%	Brighton & Hove Orig.	208—213	165—170*	...
244,200	,,	,,	8	8½%	Do. A Ord. Stk.	154—159	120—125*	...
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max.	..	..	89½—90½
530,000	20	Mch. 15	12½	10%	British	44—45	30—32	...
120,000	Stk.	June 29	4	4%	Do. 4 p.c. Deb. Stk.	88—90	75—80	75
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	53—58	...
100,000	10	June 1	—	7%	Cape Town & Dis., Ltd.	1½—2½	6½—7½	...
100,000	10	Apl. 27	—	4½%	Do. 4½ p.c. Pref.	4—6	6½—7½	6½—7
100,000	Stk.	June 29	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	73—78	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	..	...
1,513,280	,,	July 27	5/9/4	56/—	Commercial 4 p.c. Stk.	106—108	93—98	...
560,000	,,	,,	5½	55/—	Do. 3½ p.c. do.	103—105	93—98	95—95½
475,000	,,	June 15	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	55—60	...
800,000	,,	Dec. 15	4	—	Continental Union, Ltd.	76—79	30—40	...
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	55—60	...
51,600	,,	Feb. 23	15	15%	Croydon A 10 p.c.	..	..	...
278,400	—	,,	12	12%	Croydon B and C 7 p.c.	..	..	...
492,270	Stk.	—	6	4½%	Derby Con. Stk.	123—125	80	...
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	65	...
1,002,180	10	July 13	10	5/0	European, Ltd.	17⅛—18	11⅛—12⅛	10—11⅞
16,298,975	Stk.	July 27	4/17/4	52/—	Gas Light and Coke { 4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref. 3 p.c. Con. Deb.	98—102	94⅛—96½	94⅛—95⅛
2,600,000	,,	,,	3½	35/—		76—79	61—64	62⅛—63⅛
4,062,235	,,	,,	4	4%		96—99	79—82	80—81
4,674,850	,,	June 15	3	3%		72¼—74¼	62—65	...
130,000	,,	Dec. 11	10	10%	Do. 5 p.c. Bonds	..	..	...
82,500	,,	Sept. 14	5	3½%	Hastings & St. L. 5 p.c.	..	78—81	...
258,740	,,	Mch. 15	3½	2½%	Do. 3½ p.c.	87—89	60—63	...
70,000	10	May 18	11	5%	Hongkong & China, Ltd.	16¼—16½	6—7	...
86,600	Stk.	Aug. 24	9	9½%	Hornsey 7 p.c.	..	127—132*	...
131,000	,,	Aug. 10	7½	7½%	Ilford A and C	151—154	..	...
65,780	,,	,,	6½	5½%	Do. B.	115—118	..	...
65,500	,,	June 29	4	4%	Do. 4 p.c. Deb.	92—94	..	...
1,976,000	,,	May 18	9	10%	Imperial Continental	150—160	147—152	146—151
404,800	,,	Aug. 10	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	70—75	...
235,242	,,	July 27	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	95—100	...
2,498,905	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord. { A. B.	211—213	..	...
306,083	,,	June 26	4	4%		146—148	..	...
165,736	,,	Aug. 10	7/5/6	87/3	Do. 4 p.c. Pr. Deb. Stk.	..	..	...
63,480	,,	June 29	—	3%	Maidstone 5 p.c.	..	87—92	...
75,000	5	,,	6	6%	Do. 3 p.c. Deb	..	54—59	...
250,000	100	Apl. 3	4½	4½%	Malta & Mediterranean Met. of { 4½ p.c. Deb.	4½—4¾	3¼—3⅜	...
341,920	Stk.	June 1	4	4%	Melbourne	99—101	97—98	...
1,875,892	,,	July 27	4½	4½%	Monte Video, Ltd.	11½—12	63—68	63½
529,705	,,	June 29	3½	3½%	Newcastle & Gatsh'd Con.	98½—99½	80½—81½	...
15,000	10	Aug. 26	—	7/6	Do. 3½ p.c. Deb.	82—83	68—70	...
55,940	10	Aug. 24	7/14/0	7/8⅜	North Middlesex 10 p.c.	..	12⅜—13	...
300,000	Stk.	May 18	8	8%	,, ,, 7 p.c.	14—15	10½—11½*	...
60,000	5	—	10	—	Oriental, Ltd.	117—122	92—97	...
188,120	Stk.	June 29	—	6/3/9%	Ottoman, Ltd.	7¼—7½	2—3	...
60,000	50	Aug. 24	13	65/—	Plym'th & Stonh'se 5 p.c.	..	93—98	...
100,000	50	,,	12	60/—	Portsea Island, B	128—131	100—105*	...
249,980	5	—	8	—	Do. C	118—121	85—90*	...
499,960	5	—	5	—	Primitiva Ord.	5⅛—6	⅞—1	14/3
521,600	100	June 1	4	4%	Do. 5 p.c. Pref.	4½—5	1¼—2¼	39/0—40/9
600,000	Stk.	July 27	4	4%	Do. 4 p.c. Deb.	91—93	70—75	70
346,198	,,	June 29	4	4%	Do. ,, ,, 1911	..	55—60	...
150,000	10	Mch. 30	6	6/—	River Plate { 4 p.c. Deb. 5 p.c. Deb.	85—87	53—58	55
125,000	50	July 3	5	5%		10½—11	5⅛—6⅛	...
135,000	Stk.	Aug. 24	10	5%	San Paulo { 6 p.c. Pref. 5 p.c. Deb.	47—49	35—38	...
209,984	,,	,,	10	5%		223—224	95—97*	...
523,500	,,	,,	10	5%	Sheffield A	222—224	95—97*	...
133,201	Stk.	Sept. 15	4	4%	Do. B	220—222	95—97*	...
90,000	10	June 29	9	7½%	Do. C	..	..	...
6,609,895	Stk.	July 27	5/4/0	5%	Shrewsbury 5 p.c.	10½—11½	7—9	...
250,000	,,	July 13	—	3%	South African	111—113	94—97	93⅛—96½
1,895,445	,,	,,	3	3%	South Met. Ord.	..	94—96	...
224,820	,,	Aug. 24	8½	8½%	Do. Red. Pref.	..	61—64	...
1,087,795	,,	,,	6	6%	Do. 3 p.c. Deb.	72¼—74¼	106—108*	...
368,837	,,	June 15	5	5%	South Shields Con. Stk.	157—159	97—100*	99
647,740	,,	May 18	5	5%	S'th Suburb'n Ord. 5 p.c.	114—116	95—100	...
121,275	,,	June 29	4	4%	Do. 5 p.c. Deb. Stk.	116—118	75—80	...
120,000	,,	July 27	—	7½%	Southampton Ord.	99—102	63—68	...
782,275	,,	,,	6	6%	Do. 4 p.c. Deb. Stk.	..	110—115	...
181,255	,,	June 15	4	4%	Tottenham District { A 5 p.c. B 3½ p.c. 4 p.c. Deb.	135—138	97—102	98—99
182,380	10	Dec. 30	5	—		115—117	75—80	...
149,900	10	July 1	5	5%		87—89	1—2	...
236,476	Stk.	Aug. 24	5	2½%	Tuscan, Ltd.	5—6	45—50	...
30,000	,,	July 27	8½	72/6	Do. 5 p.c. Deb. Red.	93—95	73—75*	...
255,636	,,	,,	6½	57/6	Tynemouth 5 p.c. max.	108½—109	..	...
108,075	,,	,,	—	50/9	Wandsworth, Wimbledon, and Epsom—	..	..	...
140,865	,,	,,	—	50/9	Wandsworth A 5 p.c.	151—156	111—115	...
352,000	,,	,,	6½	53/9	Do. B 3½ p.c.	129—134	95—100	...
98,000	,,	,,	6½	58/9	Do. C.	..	85—90	...
88,4[illegible]6	,,	June 29	3	3%	New Ordinary	..	85—90	...
					Wimbledon 5 p.c.	117—122	95—100	...
					Epsom 5 p.c.	121—126	95—100	...
					3 p.c Deb. Stk.	66—69	57—60	...

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Tynemouth Gas Company's Further Reduction.—The Tynemouth Gas Company announce that for the quarter ending Dec. 31 next the price of gas will be reduced from 12·1d. to 11d. per therm to consumers in the borough of Tynemouth and the urban district of Whitley Bay and Monkseaton. The intended reduction is equal to a decrease in price of 5·1d. per 1000 c.ft., and is the third since June, 1921.

Dead Man and a Rifled Meter.—A man about seventy years old has been found dead at a house in Hulme, Manchester, occupied by Mrs. Matilda Baxendale, who goes out to work, so that for a long time each day the house is unoccupied. He was kneeling near the prepayment gas-meter, which had been forcibly opened. In one of the dead man's hands was a pair of pliers, and in the other a number of pennies.

Fire at the Bexhill Gas-Works.—The oil and tar in a water-gas holder at the Bexhill Gas-Works recently caught fire and gave some trouble to the brigade. Water, chemical extinguishers, and earth were all tried in combating the flames, which were eventually overcome by passing ammoniacal liquor through a pipe into the blazing tank. The immediate effect was to cause a flare-up; but within a comparatively short time only the accumulations of tar that had solidified on the side of the holder were left alight. After having burnt for over seven-and-a-half hours, the last flicker of the fire was quenched. Owing to the heat, the holder developed a slight leak, but this was soon repaired.

Therms and Reduced Gas Price at Milton Regis.—A report of the Gas Committee which was unanimously adopted at the monthly meeting of the Milton Regis Urban District Council recommended with the introduction of the therm system of charging a reduction in the price of gas. The present price is equivalent to 6s. 2d. per 1000 c.ft., and the reduction amounts to 7½d., bringing the charge down to the equivalent of 5s. 6½d. per 1000 c.ft. The Gas Manager (Mr. Arthur Wells) informed the Council that there was a prospect of another reduction in the March quarter. One member asked whether there was anything in the newspaper discussion about increased gas bills, and Mr. Wells replied that the outcry was "all bosh"—proceeding to read an extract from the editorial article referring to the "Daily Mail" agitation which appeared in the "JOURNAL" for Aug. 23. Mr. Down remarked that he could explain how some of the complaint arose. An old meter that he had had for many years had been tested, and it was found that the gas-works were losers. He had a new meter put in, and his bill now was three times greater. This was what upset people who did not want to pay what was honest and fair.

Stockport Charges Reduced.—Reduced charges to consumers recommended by the Gas Committee have been agreed to by the Stockport Town Council. It was resolved that the price of gas through ordinary meters be reduced by 6d. per 1000 c.ft.; that the last day for discount be 21 days from the date of posting the account, and that discount be allowed at the rate of 6d. per 1000 c.ft.; that the surcharge of 2d. per 1s. to consumers through automatic meters be withdrawn; that where automatic meters have been changed and no surcharge made, a refund of 10d. per 1000 c.ft. be granted; and that the reductions become operative for the September quarter readings, and the discount on the December quarter accounts. Sir Thomas Rowbotham, in moving the adoption of the minutes of the Gas Committee, said they had had to bear in mind the fact that there was still an adverse balance of £45,000 to wipe off. Their idea had been to clear it off in the course of three years. Had there been no adverse balance, they could have made larger reductions. The net price of gas in Stockport would now be 4s. 7d. per 1000 c.ft. Mr. J. Brickell said the Council had to remember that the actual amount taken from the profits for the relief of the rates from 1897 to 1916 amounted to £249,386, and yet quite recently the gas-works had been partly rebuilt on a loan of something like £100,000. Had that money not gone to the relief of the rates, the undertaking would have had a substantial reserve fund.

Ellesmere Gas Problem.—The question of the reconstruction of the gas works was again brought up at a meeting of the Ellesmere Urban Council last week, when the Gas Committee recommended that a loan should be applied for to enable the Council to purchase a new holder. Mr. Tims moved that the report be not accepted, and said it would be foolish to replace the holder, when the rest of the plant was practically obsolete. They ought to carry on with the present holder until they could take advantage of the new electricity supply, which would be available in the near future. The Chairman (Mr. Brownlow R. C. Tower) said that the report was drawn up by the Gas Manager (Mr. F. Ashley), who stated that there was considerable leakage from the old holder, and that they must either repair it, which meant that no supply could be given while the work was being carried out, or else they must have a new one. He contradicted the statement that the gas-works were obsolete. Eventually a deputation was appointed to visit Wem Gas-Works, to see what was being done there.

Among the orders received last month by Messrs. Meldrums Ltd., of Timperley, near Manchester, for their forced-draught furnaces were six from gas undertakings.

Effect has now been given in Birmingham to the recent wage readjustment, the decrease in the gas-meter making and sheet metal trades being at the rate of 5s. 6d. per week.

Thurles streets have for a long period been lighted by gas, but the Urban Council have now decided to restore paraffin oil lamps—a decision which has not met with public approval.

On the 22nd inst., the registered office of the European Gas Company, Ltd., will be transferred from Finsbury House, Blomfield Street, to Montague House, Devonshire Square, E.C. 2.

The Consett Iron Company, Ltd., co. Durham, forward particulars of sizes, approximate analyses, &c., of their high-class silica and fireclay bricks, of which there are both hand and machine made brands.

The Gas Committee have reported to the Gainsborough Urban District Council that, having considered the question of installing a carburetted water-gas plant, they had resolved to take no further action in the matter.

The Blackburn Town Council have approved an application to the Board of Trade for a Special Order under section 10 of the Gas Regulation Act, authorizing the borrowing of £10,000 for additional plant at the Greenbank works.

"We cannot cope with the lighting of the city at all, owing to the smashing of gas-lamps," said a Corporation inspector in the Belfast Police Court. He added that a staff had to be maintained specially for repairing broken lamps. The cost of smashings in a year was stated to be £1000.

Miss A. Neilans, Secretary to the Association for Moral and Social Hygiene, addressing the women students and magistrates at the summer school of the National Union of Societies for Equal Citizenship, declared that well-lighted streets were the best protection against immorality.

The Guiseley Urban District Council have decided not to appoint a special gas examiner for the area, but that the Council's Surveyor shall act as gas examiner for the time being. It was stated by one member that during the last few weeks there had been a considerable improvement in the gas supply.

Hundreds of traders and shopkeepers from all parts of the country visited Preston last week, for the historic Guild. The progress made since the Guild of twenty years ago in the application of gas for domestic purposes was illustrated by the Preston Gas Company's exhibits. In the first place there was shown the use of gas-cookers, and in the second a sitting room heated by a gas-fire.

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Continued on p. 606.